APPENDIX

APPENDIX A

UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

CHEMOURS COMPANY FC, LLC,
Appellant

v.

DAIKIN INDUSTRIES, LTD.,
DAIKIN AMERICA, INC.,
Appellees

ANDREW HIRSHFELD, PERFORMING THE FUNCTIONS AND DUTIES OF THE UNDER SECRETARY OF COMMERCE FOR INTELLECTUAL PROPERTY AND DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE,
Intervenor

2020-1289, 2020-1290

Appeals from the United States Patent and Trademark Office, Patent Trial and Appeal Board in Nos. IPR2018-00992, IPR2018-00993.

Decided: July 22, 2021

NITIKA GUPTA FIORELLA, Fish & Richardson, PC, Wilmington, DE, argued for appellant. Also represented by MARTINA TYREUS HUFNAL; TIMOTHY RAWSON, San Diego, CA.

GREGORY A. CASTANIAS, Jones Day, Washington, DC, argued for appellees. Also represented by JOHN CHARLES EVANS, DAVID MICHAEL MAIORANA, Cleveland, OH; ANTHONY INSOGNA, San Diego, CA.

MONICA BARNES LATEEF, Office of the Solicitor, United States Patent and Trademark Office, Alexandria, VA, for intervenor. Also represented by THOMAS W. KRAUSE, MAUREEN DONOVAN QUELER, FARHEENA YASMEEN RASHEED.

Before NEWMAN, DYK, and REYNA, *Circuit Judges*.

Opinion for the court filed by *Circuit Judge* REYNA.

Opinion concurring in part and dissenting in part filed by *Circuit Judge* DYK.

REYNA, *Circuit Judge*.

Chemours Company FC, LLC, appeals the final written decisions of the Patent Trial and Appeal Board from two inter partes reviews brought by Daikan Industries, Ltd., et al. Chemours argues on appeal that the Board erred in its obviousness factual findings and did not provide adequate support for its analysis of objective indicia of nonobviousness. Chemours also argues that the Board issued its decision in violation of the Appointments Clause because the Board's decision came after this court's decision in *Arthrex, Inc. v. Smith & Nephew, Inc.*, 941 F.3d 1320, 1335 (Fed. Cir. 2019), but before this court issued its mandate. Chemours argues that the Board's decision should be vacated and remanded.[1] We decline to vacate and remand this case pursuant to *Arthrex*. We conclude that the Board's decision on obviousness is not supported by substantial evidence and that the Board erred in its analysis of objective indicia of nonobviousness. Accordingly, we reverse.

BACKGROUND

This consolidated appeal arises from two final written decisions in inter partes reviews, *Daikin Industries Ltd. v. Chemours Co. FC, LLC*, No. IPR2018-00992 (P.T.A.B. Nov. 12, 2019), and *Daikin Industries Ltd. v. Chemours Co. FC, LLC*, No. IPR2018-00993 (P.T.A.B. Nov. 12, 2019). J.A. 1–129. Daikin Industries Ltd. and Daikin America, Inc. (collectively, "Daikin") filed a petition at the Patent Trial and Appeal Board ("Board") requesting an inter partes review of claims 1–7 of U.S. Patent No. 7,122,609 (the "'609 patent"). IPR2018-00992, J.A. 1–67. Daikin also filed a petition requesting an inter partes review of claims 3 and 4 of U.S. Patent No. 8,076,431[2] (the "'431 patent"). IPR 2018-00993, J.A. 68–129.

The '609 patent relates to a unique polymer for insulating communication cables formed by pulling wires through melted polymer to coat and insulate the

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[1] Following the Supreme Court's decision in *United States v. Arthrex, Inc.*, 141 S. Ct. 1970, 210 L.Ed.2d 268 (2021), Chemours withdrew its request to vacate and remand to the Board. ECF No. 66.

[2] The asserted claims include claims 3 and 4 because claims 1, 2, and 5–7 of the '431 patent were disclaimed. J.A. 3716

wires, a process known as "extrusion."[3] '609 patent col. 3 ll. 50–63. Specifically, Chemours's patents relate to a polymer with unique properties such that it can be formed at high extrusion speeds while still producing a high-quality coating on the communication cables. *Id.* Most relevant to the issues in this appeal, the claims provide that the polymer has a specific melt flow rate range, i.e., "a high melt flow rate of about 30 ±3 g/10 min," which is the rate at which melted polymer flows under pressure. '609 patent col. 10 ll. 19–20. The melt flow rate of a polymer is an indicator of how fast the melted polymer can flow under pressure, i.e., during extrusion. Appellant's Br. 3. The higher the melt flow rate, the faster the polymer can be coated onto a wire. J.A. 1150–1151 at ¶ 32. Claim 1 of the '609 patent is representative of the issues on appeal:

> 1. A partially-crystalline copolymer comprising tetrafluoroethylene, hexafluoropropylene in an amount corresponding to a hexafluoropropylene index (HFPl) of from about 2.8 to 5.3, said copolymer being polymerized and isolated in the absence of added alkali metal salt, having a melt flow rate of within the range of about 30±3 g/10 min, and having no more than about 50 unstable endgroups/10^6 carbon atoms.

'609 patent col. 10 ll. 15–21.

The Board found all challenged claims of the '609 patent and the '431 patent to be unpatentable as

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[3] The specifications for both patents are nearly identical as are the issues on appeal for both patents. *See* Appellant's Br. 2 n.1. When referencing both patents, this opinion will cite to the '609 patent and IPR2018-00992, J.A. 1-67.

obvious in view of U.S. Patent No. 6,541,588 ("Kaulbach"). J.A. 66, 345–51.

Chemours appeals. We have jurisdiction under 28 U.S.C. § 1295(a)(4)(A).

STANDARD OF REVIEW

This court reviews the Board's legal determinations de novo and its factual determinations for substantial evidence. *See In re NuVasive, Inc.*, 842 F.3d 1376, 1379 (Fed. Cir. 2016). Substantial evidence requires more than a "mere scintilla" and must be enough such that a reasonable mind could accept the evidence as adequate to support the conclusion. *Consol. Edison Co. v. NLRB*, 305 U.S. 197, 229 (1938).

Obviousness is a question of law based on underlying findings of fact. *See In re NuVasive, Inc.*, 842 F.3d at 1381. "What the prior art teaches, whether a person of ordinary skill in the art would have been motivated to combine references, and whether a reference teaches away from the claimed invention are questions of fact." *Meiresonne v. Google, Inc.*, 849 F.3d 1379, 1382 (Fed. Cir. 2017) (quoting *Apple Inc. v. Samsung Elecs. Co.*, 839 F.3d 1034, 1047–48 (Fed. Cir. 2016) (en banc)).

In making its factual findings, the Board must have both an adequate evidentiary basis for its findings and articulate a satisfactory explanation for those findings. *NuVasive*, 842 F.3d at 1382 (citing *In re Lee*, 277 F.3d 1338, 1344 (Fed. Cir. 2002) and *Synopsys, Inc. v. Mentor Graphics Corp.*, 814 F.3d 1309, 1322 (Fed. Cir. 2016)). We review for substantial evidence the underlying factual findings leading to an obviousness conclusion. *Wasica Fin. GmbH v. Cont'l Auto. Sys., Inc.*, 853 F.3d 1272, 1278 (Fed. Cir. 2017).

DISCUSSION

We first address Chemours's argument concerning this court's decision in *Arthrex, Inc. v. Smith & Nephew, Inc.*, 941 F.3d 1320, 1335 (Fed. Cir. 2019).

I

Chemours argues that the Board's decision was issued in violation of the Appointments Clause because the Board issued its final written decisions in both inter partes reviews on November 12, 2019, which was after this court's decision in *Arthrex*, but before the mandate was issued. Specifically, Chemours contends remand is required in this instance because the *Arthrex*: decision was not final until its mandate issued, so the court had not cured the constitutional defect by the time the final written decisions were issued. Appellant's Br. 42.

Because Chemours has withdrawn its request based on *Arthrex* to vacate and remand to the Board, we decline to vacate the Board's decision and remand to the Board.

II

Chemours argues that the Board's final written decision on obviousness is erroneous because its factual findings on motivation to combine are unsupported by substantial evidence. Appellant's Br. 19. Specifically, Chemours argues that Daikin did not meet its burden of proof because it failed to show that a person of ordinary skill in the art ("POSA") would modify Kaulbach's polymer to achieve the claimed invention. *Id.* at 25–31.

The Kaulbach reference teaches a polymer for wire and cable coatings that can be processed at higher speeds and at higher temperatures. Kaulbach col. 3 ll. 3–5. Kaulbach highlights that the polymer of the invention has a "very narrow molecular weight distribution." *Id.* at col. 3 ll. 34–35, 59–65. Kaulbach discovered that prior beliefs that polymers in high-speed extrusion application needed broad molecular weight distributions were incorrect because "a narrow molecular weight distribution performs better."[4] *Id.* at col. 3 ll. 61–65; *see also* col. 1 ll. 57–59. In order to achieve a narrower range, Kaulbach reduced the concentration of heavy metals such as iron, nickel and chromium in the polymer. *Id.* at col. 3 ll. 24–33.

In the description of the invention, Kaulbach suggests that polymers used in "high speed wire extrusion" have melt flow rates of 15 g/10 min or greater. *Id.* at col. 3 ll. 43–44. In the Kaulbach example relied on by the Board, Sample A11, Kaulbach's melt flow rate is 24 g/10 min, while the claimed rate is 30±3 g/10 min. *Id.* at col.9 ll. 3–15.[5] Kaulbach further touts as a benefit that the melt flow rate does not change during processing. *Id.* at col. 3 ll. 49–50, col. 4 ll. 1–2, col. 4 ll. 7–11.

The Board found that Kaulbach's melt flow rate range fully encompassed the claimed range, and that

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[4] Molecular weight distribution reflects the range of molecular weights (or chain lengths) in a given polymer. J.A. 1145 at ¶ 20. A polymer with a narrower molecular weight distribution has more polymer chains that are or similar lengths, while a broad molecular weight distribution fluorinated ethylene propylene ("FEP") has more variation in polymer chain lengths. *Id.*

[5] Kaulbach refers to a "melt flow index" or "MFI" value. Kaulbach col.1 ll. 40–41, col. 3 ll. 43–44. Chemours acknowledges that "melt flow index" and "melt flow rate" may be used interchangeably.

a skilled artisan would have been motivated to increase the melt flow rate of Kaulbach's preferred embodiment to within the claimed range in order to coat wires faster. J.A. 45–46. In making its findings, the Board relied on the teachings of other evidence. J.A. 42–46. Specifically, the Board found the following:

> In view of Kaulbach's disclosure that [melt flow rate] values of ≥15 g/10 min are suitable for high[-] speed wire extrusion, and record evidence establishing that higher coating speeds of 2800 or 3000 ft/min are possible, we are persuaded that the skilled artisan would have been motivated to improve upon the wire coating speeds observed with Kaulbach's Sample A11. We also are persuaded that the skilled artisan would have been motivated to increase the [melt flow rate] of Kaulbach's Sample A11 to be within the recited range in order to achieve higher processing speeds, because the evidence of record teaches that achieving such speeds may be possible by increasing a [polymer's] [melt flow rate].

J.A. 45–46.

While acknowledging that Kaulbach states that " 'a narrow molecular weight distribution performs better' at achieving high processing rates than polymers with 'broad' molecular distributions," J.A. 50–51, the Board also found that "it is not clear on this fully developed record why the skilled artisan would have been motivated to maintain such a narrow molecular weight distribution when seeking to achieve even higher coating speeds with Kaulbach's Sample A11," J.A. 50. In addition, the Board found that the portions of Kaulbach's disclosure lacked specificity regarding what is deemed "narrow" and "broad," and that it would have been obvious to "broaden" the molecular weight distribution of the claimed polymer:

> [E]ven though Kaulbach generically touts that "high processing rates can be achieved" "[d]espite a narrow molecular weight distribution" ([Kaulbach], 3:59–60), this purported discovery would not have prevented the skilled artisan, at the time of the invention of the '609 patent, from considering other techniques—such as broadening the polymer's molecular weight distribution—to achieve higher coating speeds with Sample A11. Based on the evidence presented, we are persuaded that one such technique would have included increasing Sample A11's [melt flow rate] from 24 g/10 min to the recited range of "about 30±3 g/10 min," even if doing so would have required broadening the molecular weight distribution of the polymer beyond the "narrow molecular weight distribution" suggested, but not required or precisely defined, by Kaulbach.

J.A. 51.

The Board's obviousness findings are not supported by substantial evidence. Although the Board may rely on other prior art to inform itself of the state of the art at the time of the invention, the scope of the relevant prior art is that which is " 'reasonably pertinent to the particular problem with which the inventor was involved.' " *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1535 (Fed. Cir. 1983) (quoting *In re Wood*, 599 F.2d 1032, 1036 (C.C.P.A. 1979)). In deciding whether a reference is from a relevant art, it is key to first determine whether the reference is within the inventor's field of endeavor, and if not, "whether the reference is reasonably pertinent to the particular problem confronting the inventor." *In re GPAC Inc.*, 57 F.3d 1573, 1578 (Fed. Cir. 1995) (citing *Wood*, 599 F.2d at 1036). Here, the Board appears to have ignored the express disclosure in Kaulbach that teaches away from the claimed invention and relied on teachings from other references that were not concerned with the particular problems Kaulbach sought to solve. In other words, the Board did not adequately grapple with why a skilled artisan would find it obvious to increase Kaulbach's melt flow rate to the claimed range while retaining its critical "very narrow molecular-weight distribution." Kaulbach col. 3 ll. 34–35, 59–65.

The reasons that the Board provided are not persuasive. The Board found that because "Kaulbach does not specifically set forth numerical limits on [what constitutes] 'narrow' and 'broad' molecular weight distributions, it is plausible that the skilled artisan may have been able to slightly increase Sample A11's [melt flow rate] of 24 g/10 min to be within the claimed range, and still end up with a 'narrow' [molecular weight distribution] polymer as suggested by Kaulbach, even if that meant slightly 'broadening' Sample A11's [molecular weight distribution]." J.A. 49. This does not explain why a POSA would be motivated to increase Kaulbach's melt flow rate to the claimed range, when doing so would necessarily involve altering the inventive concept of a narrow molecular weight distribution polymer. *See Trivascular, Inc. v. Samuels*, 812 F.3d 1056, 1068

(Fed. Cir. 2016) (finding no motivation to modify the prior art where doing so "would destroy the basic objective" of the prior art).

This is particularly true in light of the fact that the Kaulbach reference appears to teach away from broadening molecular weight distribution and the known methods for increasing melt flow rate. Specifically, Kaulbach includes numerous examples of processing techniques that are typically used to increase melt flow rate, which Kaulbach cautions should *not* be used due to the risk of obtaining a broader molecular weight distribution. Kaulbach col. 4 ll. 47–50. For example, Kaulbach teaches against using chain transfer agents during polymerization, because they "intrinsically broaden the molecular weight distribution." *Id.*; *see also id.* at col. 5 ll. 23–27 (teaching against using high fluorination temperatures, because doing so "can result in a broadening of the molecular weight distribution and negatively effect [sic] performance"). These factors do not demonstrate that a POSA would have had a "reason to attempt" to get within the claimed range, as is required to make such an obviousness finding. *Procter & Gamble Co. v. Teva Pham. USA, Inc.*, 566 F.3d 989, 995 (Fed. Cir. 2009) (quoting *PharmaStem Therapeutics, Inc. v. ViaCell, Inc.*, 491 F.3d 1342, 1360 (Fed. Cir. 2007)).

Daikin points out that Chemours based its case on an unclaimed feature—molecular weight distribution. However, Kaulbach is the sole prior art relied on by the Board, and Kaulbach identified a narrow molecular weight distribution as a key feature. Therefore, modifying Kaulbach as the Board suggested would not be obvious absent additional evidence supporting that finding. As Chemours persuasively argues, the Board needed competent proof showing a skilled artisan would have been motivated to, and reasonably expected to be able to, increase the melt flow rate of Kaulbach's polymer to the claimed range when all known methods for doing so would go against Kaulbach's invention by broadening molecular weight distribution. Appellant's Br. 12.

We hold that the Board relied on an inadequate evidentiary basis and failed to articulate a satisfactory explanation that is based on substantial evidence for why a POSA would have been motivated to increase Kaulbach's melt flow rate to the claimed range, when doing so would necessarily involve altering the inventive concept of a narrow molecular weight distribution polymer.

III

Before making a determination on the ultimate question of obviousness, the Board analyzed Chemours's objective indicia of nonobviousness. J.A. 52. Chemours argues that the Board legally erred in its analysis of objective indicia of nonobviousness finding an insufficient nexus between the claimed invention and FEP 9494, Chemours's commercial polymer, and its requirement of market share evidence to show commercial success. Appellant's Br. 38. Chemours also argues that the Board misapplied the law on finding that the patents at issue were blocking patents. *Id.* at 39.

In an obviousness inquiry, evidence of objective indicia of nonobviousness must be considered if present. *See Pentec, Inc. v. Graphic Controls Corp.*, 776 F.2d 309, 315 (Fed. Cir. 1985). Such evidence includes, for example, the commercial success of the patented invention. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

A

Chemours argues that the Board improperly rejected an extensive showing of commercial success by finding no nexus on a limitation-by-limitation basis, rather than the invention as a whole. Appellant's Br. 36. Chemours contends that the novel combination of these properties drove the commercial success of FEP 9494. *Id.* Second, Chemours argues the Board improperly required Chemours to proffer market share data to show commercial success.

In general, evidence supporting objective indicia of nonobviousness must be shown to have a nexus to the claimed invention. *In re GPAC Inc.*, 57 F.3d at 1580. In the obviousness analysis, "the claimed invention is, admittedly, a combination of elements that were known individually in the prior art." *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1332 (Fed. Cir. 2016). Evidence of commercial success, therefore, can be linked to an "inventive combination of known elements" to show a sufficient nexus. *Id.*; *see also Rambus Inc. v. Rea*, 731 F.3d 1248, 1256–58 (Fed. Cir. 2013) (holding that the Board erred when it found objective evidence lacked a nexus where at least some of the evidence related to the "patented design as a whole").

The Board found no nexus between the claimed invention and the alleged commercial success because Kaulbach disclosed all features except for the claimed melt flow rate. J.A. 56. The Board then found that other prior art of record disclosed melt flow rates of 50 g/10 min. *Id.*

Contrary to the Board's decision, the separate disclosure of individual limitations, where the invention is a unique combination of three interdependent properties, does not negate a nexus. Concluding otherwise would mean that nexus could never exist where the claimed invention is a unique combination of known elements from the prior art. *See WBIP*, 829 F.3d at 1332.

Chemours also contends that the Board erred in its demand that market share evidence is necessary to sustain a finding of commercial success. Appellant's Br. 38. Chemours argues that this court has held that evidence of market share is not required to prove commercial success. Appellant's Br. 38–39. Chemours contends that sales data alone should be enough for commercial success. *Id.* We agree.

"When a patentee can demonstrate commercial success, usually shown by significant sales in a relevant market, and that the successful product is the invention disclosed and claimed in the patent, it is presumed that the commercial success is due to the patented invention." .*J.T. Eaton & Co. v. Atl. Paste & Glue Co.*, 106 F.3d 1563, 1571 (Fed. Cir. 1997); *WBIP*, 829 F.3d at 1329. However, market share data, though potentially useful, is not required to show commercial success. *See Tec Air, Inc. v. Denso Mfg. Mich. Inc.*, 192 F.3d 1353, 1360–61 (Fed. Cir. 1999) ("Although sales figures coupled with market data provide stronger evidence of commercial success, sales figures alone are also evidence of commercial success."); *Gambro Lundia AB v. Baxter Healthcare*

Corp., 110 F.3d 1573, 1579 (Fed. Cir. 1997) (relying on sales information to show commercial success); *J.T. Eaton*, 106 F.3d at 1566, 1572 (same).

The Board is certainly entitled to weigh evidence and find, if appropriate, that Chemours's gross sales data were insufficient to show commercial success without market share data. The Board, however, erred in its analysis that gross sales figures, absent market share data, "are inadequate to establish commercial success." J.A. 57.

B

Finally, Chemours contends that the Board erred when it found that the asserted patents were "blocking patents," that blocked others from entering the relevant market. Appellant's Br. 39–41.

A blocking patent is an earlier patent that prevents practice of a later invention—the invention of the patent-in-dispute. *See Acorda Therapeutics, Inc. v. Roxane Labs.*, Inc., 903 F.3d 1310, 1337 (Fed. Cir. 2018) ("A patent has been called a 'blocking patent' where practice of a later invention would infringe the earlier patent."); *Galderma Labs., L.P. v. Tolmar, Inc.*, 737 F.3d 731, 740 (Fed. Cir. 2013); *Prima Tek II, LLC v. A-Roo Co.*, 222 F.3d 1372, 1379 (Fed. Cir. 2000).

The Board determined that the existence of the '609 patent covering the FEP 9494 product would have precluded others from freely entering the market. J.A. 57–58 (citing *Galderma Labs.*, 737 F.3d at 740 (concluding that the inference of nonobviousness based on evidence of commercial success is weak where market entry by others is precluded due to blocking patents)). The Board concluded that the evidence proffered to establish commercial success was weak because the ’609 patent covering it blocked others from entering the market. J.A. 58.

The Board erred by misapplying the “blocking patents” doctrine to the challenged patents themselves. A blocking patent is one that is in place before the claimed invention because “such a blocking patent may deter non-owners and nonlicensees from investing the resources needed to make, develop, and market such a later, ‘blocked’ invention.’ ” *Acorda*, 903 F.3d at 1337. However, the challenged patent, which covers the claimed invention at issue, cannot act as a blocking patent. Accordingly, we reverse the Board as to these findings.

CONCLUSION

We decline to vacate and remand this case pursuant to *Arthrex*. We hold that the Board’s obviousness determination is not supported by substantial evidence and that the Board erred in its analysis of certain objective indicia of nonobviousness. Accordingly, we reverse the Board’s determination.

REVERSED

* * *

DYK, *Circuit Judge*, concurring in part and dissenting in part.

I agree with Part I of the majority’s opinion and with the majority’s conclusion in Part III that the Patent Trial and Appeal Board (“Board”) erred “in its analysis that gross sales figures, absent market share data, ‘are inadequate to establish commercial success,’ ” Maj. Op. 1378 (quoting J.A. 57), and “by misapplying the ‘blocking patents’ doctrine to the challenged patents themselves,” *id.* at 1379.

I respectfully dissent as to Part II. I think that the majority's conclusion that U.S. Patent No. 6,541,588 ("Kaulbach") teaches away from the claimed invention is contrary to our precedent and that the Board properly rejected the teaching away theory.

I

Claim 1 of U.S. Patent No. 7,122,609 ("the '609 patent") covers

> A partially-crystalline copolymer comprising tetrafluoroethylene, hexafluoropropylene in an amount corresponding to a hexafluoropropylene index (HFPI) of from about 2.8 to 5.3, said copolymer being polymerized and isolated in the absence of added alkali metal salt, having a melt flow rate of within the range of about 30±3 g/10 min, and having no more than about 50 unstable end-groups/10^6 carbon atoms.

'609 patent col. 10 ll. 15–21.

Like claim 1 of the '609 patent, Kaulbach discloses a copolymer for high-speed extrusion coating of cables or wires. Kaulbach's copolymer is nearly identical to the polymer disclosed by claim 1 of the '609 patent: Both copolymers are tetrafluoroethylene and hexafluoropropylene copolymers with decreased metal contamination and a low number of unstable endgroups. The only material difference between claim 1 and Kaulbach is that Kaulbach discloses (in Sample A11) a melt flow rate of 24 g/10 min, slightly lower than 27 g/10 min, the lower bound of the 30 ± 3 g/10 min rate claimed in claim 1 of the '609 patent.

The majority nevertheless concludes that Kaulbach teaches away from the claimed invention because increasing "Kaulbach's melt flow rate to the claimed range . . . would necessarily involve altering [Kaulbach's] inventive concept of a narrow molecular weight distribution polymer." Maj. Op. 1376–77. I disagree. Although it is true that Kaulbach's invention is a narrow molecular weight distribution polymer, Kaulbach also acknowledges that "the art t[aught] that a broad molecular weight distribution [wa]s needed to achieve such high processing rates," Kaulbach col. 3 ll. 60–62, and that prior art "mixtures ha[d] a very broad molecular weight distribution[,] which[,] according to conventional wisdom, results in an improved extrudability," *id.* col. 1 ll. 57–59. Thus, even though Kaulbach determined that "a narrow molecular weight distribution performs better," it expressly acknowledged the feasibility of using a broad molecular weight distribution to create polymers for high speed extrusion coating of wires. *Id.* col. 3 ll. 62–65. This is not a teaching away from the use of a higher molecular weight distribution polymer.

As our cases make clear, "that 'better alternatives exist in the prior art does not mean that an inferior combination is inapt for obviousness purposes.'" *Bayer Pharma AG v. Watson Lab'ys, Inc.*, 874 F.3d 1316, 1327 (Fed. Cir. 2017) (quoting *In re Mouttet*, 686 F.3d 1322, 1334 (Fed. Cir. 2012)); *see also In re Haase*, 542 F. App'x 962, 969 (Fed. Cir. 2013) (determining that a reference did not teach away from using an aluminum polymer with an ammonium polymer just because the reference "show[ed] better turbidity results when using an aluminum polymer by itself"). The majority's approach impermissibly expands the teaching away doctrine such that it encompasses a reference's mere preference for a particular alternative.

II

Contrary to the majority's assertion, modifying the molecular weight distribution of Kaulbach's disclosure of a 24 g/10 min melt flow rate to achieve the 27 g/10 min melt flow rate of claim 1 would hardly "destroy the basic objective" of Kaulbach as the majority claims. Maj. Op. 1376–77 (quoting *Trivascular, Inc. v. Samuels*, 812 F.3d 1056, 1068 (Fed. Cir. 2016)).

As the Board determined, Kaulbach does not precisely define what constitutes a narrow molecular weight distribution, only defining a "very narrow molecular weight distribution" of "less than about 2" and "as low as 1.5." Kaulbach col. 3 ll. 34–37. Sample A11 has a measured distribution of 1.6, toward the lower end of this "very narrow" distribution range. Thus, Sample A11's molecular weight distribution could be increased by 0.4 (25%) and still have a "very narrow" molecular weight distribution under Kaulbach. There is no support whatever for the theory that increasing the melt flow rate from 24 g/10 min (Kaulbach) to 27 g/10 min (the '609 patent) (a 12.5% increase) would create more than a 0.4 increase (25%) in the molecular weight distribution and thus be contrary to Kaulbach's supposed teaching to stay within the "very narrow" molecular weight distribution. The majority's contrary conclusion constitutes nothing less than appellate factfinding, factfinding that has no record support.

I would therefore affirm the Board's determination that Kaulbach does not teach away from the claimed invention and remand to the Board for redetermination of the conclusion of obviousness in light of the secondary factors. I respectfully dissent from the majority's contrary conclusion.

APPENDIX B

NOTE: This order is nonprecedential.

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

CHEMOURS COMPANY FC, LLC,
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DAIKIN INDUSTRIES, LTD.,
DAIKIN AMERICA, INC.,
Appellees

ANDREW HIRSHFELD, PERFORMING THE FUNCTIONS AND DUTIES OF THE UNDER SECRETARY OF COMMERCE FOR INTELLECTUAL PROPERTY AND DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE,
Intervenor

2020-1289, 2020-1290

Appeals from the United States Patent and Trademark Office, Patent Trial and Appeal Board in Nos. IPR2018-00992, IPR2018-00993.

ON PETITION FOR PANEL REHEARING AND REHEARING EN BANC

Before MOORE, *Chief Judge*, NEWMAN, LOURIE, DYK, PROST, O'MALLEY, REYNA, TARANTO, CHEN, HUGHES, STOLL, and CUNNINGHAM, *Circuit Judges*.

PER CURIAM.

O R D E R

Daikin Industries, Ltd. and Daikin America, Inc. filed a combined petition for panel rehearing and rehearing en banc. A response to the petition was invited by the court and filed by Chemours Company FC, LLC. The petition was referred to the panel that heard the appeal, and thereafter the petition for rehearing en banc was referred to the circuit judges who are in regular active service.

Upon consideration thereof,

IT IS ORDERED THAT:

The petition for panel rehearing is denied.

The petition for rehearing en banc is denied.

The mandate of the court will issue on November 22, 2021.

FOR THE COURT

November 15, 2021	/s/ Peter R. Marksteiner
Date	Peter R. Marksteiner Clerk of Court

APPENDIX C

Trials@uspto.gov 571-272-7822

Paper No. 60
Entered: November 12, 2019

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DAIKIN INDUSTRIES LTD. and DAIKIN AMERICA, INC.,
Petitioner,

v.

THE CHEMOURS COMPANY FC, LLC,
Patent Owner.

IPR2018-00992
Patent 7,122,609 B2

Before JO-ANNE M. KOKOSKI, KRISTINA M. KALAN, and SHELDON M. McGEE, *Administrative Patent Judges*.

KALAN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable

35 U.S.C. § 318(a)

Dismissing Patent Owner's Motion to Exclude
37 C.F.R. § 42.64(c)

Granting/Dismissing Petitioner's and Patent Owner's Motions to Seal
37 C.F.R. § 42.54

I. INTRODUCTION

Daikin Industries Ltd. and Daikin America, Inc. (collectively, "Petitioner") filed a Petition requesting an *inter partes* review of claims 1–7 of U.S. Patent No. 7,122,609 B2 (Ex. 1001, "the '609 patent"). Paper 1 ("Pet."). The Chemours Company FC, LLC ("Patent Owner") filed a Preliminary Response to the Petition. Paper 7 ("Prelim. Resp.").

We instituted an *inter partes* review of claims 1–7 of the '609 patent on all grounds of unpatentability alleged in the Petition. Paper 8 ("Institution Decision" or "Dec."). After institution of trial, Patent Owner filed a Patent Owner Response. Paper 15 ("PO Resp."). Petitioner filed a Reply. Papers 34, 35 ("Reply"). Patent Owner filed a Sur-Reply to Petitioner's Reply. Paper 39 ("Sur-Reply").

An oral hearing was held on August 7, 2019. A transcript of the hearing is included in the record. Paper 59 ("Tr.").

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a). For the reasons that follow, we determine that Petitioner has established by a preponderance of the evidence that claims 1–7 of the '609 patent are unpatentable.

A. Related Proceedings

The parties identify the following district court proceeding as related to the '609 patent: *Chemours Company FC, LLC v. Daikin Industries, Ltd.*, Civil

Action No. l:17-cv-01612-GMS (D. Del.). Pet. 62; Paper 4, 2.

B. The ’609 Patent

The ’609 patent, titled “High Melt Flow Fluoropolymer,” issued on October 17, 2006. Ex. 1001, code (54), (45). The ’609 patent relates to a partially-crystalline copolymer of tetrafluoroethylene (“TFE”) and hexafluoropropylene (“HFP”) in an amount corresponding to particular hexafluoropropylene index (“HFPI”), and about 0.2% to 3% by weight of perfluoro(alkyl vinyl ether). *Id.* at code (57). Such copolymers, also known as fluorinated ethylene propylene or “FEP” copolymers, “can be extruded at high speed onto conductor over a broad polymer melt temperature range to give insulated wire of high quality.” *Id.* at 1:60–62.

According to the ’609 patent, during “conductor coating operation, the presence of alkali metal salt in the fluoropolymer promotes the formation of fluoropolymer drool on the outer surface of the extrusion” equipment, which “appear[s] as unacceptable lumps of insulation” on the conductor. *Id.* at 3:7–16. Thus, the copolymer of the ’609 patent “is free of, i.e., does not contain, alkali metal salt in the sense that no alkali metal salt is used in the polymerization or in the isolation of the resulting fluoropolymer.” *Id.* at 3:16–20.

The ’609 patent also informs that its polymers may contain thermally or hydrolytically unstable endgroups, e.g., $-CF_2CH_2OH$, $-CONH_2$, $-COF$, and $-COOH$, which react “usually by decomposition, at temperatures at which fluoropolymers are melt-processed.” *Id.* at 3:31–39. The ’609 patent thus teaches that a fluorination process is carried out to convert such "unstable endgroups to the stable $–CF_3$ endgroup." *Id.* at 3:31–34.

C. Instituted Claims

Claim 1 is the only independent claim of the '609 patent. Claims 2–7 depend directly or indirectly from claim 1. Claim 1 is reproduced below:

> 1. A partially-crystalline copolymer comprising tetrafluoroethylene, hexafluoropropylene in an amount corresponding to a hexafluoropropylene index (HFPI) of from about 2.8 to 5.3, said copolymer being polymerized and isolated in the absence of added alkali metal salt, having a melt flow rate of within the range of about 30±3 g/10 min, and having no more than about 50 unstable endgroups/10^6 carbon atoms.

Ex. 1001, 10:15–21.

D. Instituted Grounds of Unpatentability

We instituted an *inter partes* review of claims 1–7 of the '609 patent on the following grounds. Dec. 25.

Ground	**Claims Challenged**	**35 U.S.C. §**	**Reference(s)/Basis**
1	1–7	102(a)	Hiraga[1]
2	1–7	103(a)	Hiraga and/or Hiraga and Kaulbach[2]
3	1–7	102(e)(2) and/or 103(a)	Kono[3]

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[1] JP 2002-249585, published September 6, 2002 (as translated) (Ex. 1025).

[2] U.S. Pat. No. 6,541,588 B1, issued April 1, 2003 (Ex. 1009).

[3] U.S. Pat. No. 6,743,508 B2, issued June 1, 2004 (Ex. 1008).

4	1–7	103(a)	Kono
5	1–7	103(a)	Kaulbach

Petitioner relies on the Declarations of Dr. Robert A. Iezzi (Ex. 1002) and Daniel M. McGavock (Ex. 1040). Patent Owner relies on the Declarations of Dr. Sue Mecham (Ex. 2006), John L. Hansen (Ex. 2007), Randall Crenshaw (Ex. 2008), and Gregory A. Chapman (Ex. 2009).

II. ANALYSIS

A. *Claim Construction*

For petitions filed prior to November 13, 2018, the Board interprets claims in an unexpired patent using the "broadest reasonable construction in light of the specification of the patent." 37 C.F.R. § 42.100(b) (2017); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016). Under that standard, claim terms are given their ordinary and customary meaning in view of the specification, as would be understood by one of ordinary skill in the art at the time of the invention. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Any special definitions for claim terms must be set forth in the specification with reasonable clarity, deliberateness, and precision. *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). Only those terms that are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) ("we need only construe terms 'that are in controversy, and only to the extent necessary to resolve the controversy'") (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

Petitioner offered proposed constructions for the terms "polymerized and isolated," "about 30±3 g/10 min," and "about 50 unstable endgroups." Pet. 17–24. In the latter proposed construction, Petitioner includes a separate proposed construction for the phrase "unstable endgroup." *Id.* at 24. Petitioner urges that the broadest reasonable construction of the term "unstable endgroup" includes "unstable endgroups resulting from *any* FEP polymerization process" and not only those exemplified in the '609 patent. *Id.* (emphasis added). Petitioner notes that although the '609 patent identifies four unstable endgroups ($–CONH_2$, $–CF_2CH_2OH$, –COF, and –COOH), "other unstable endgroups are also possible," such as ethyl endgroups. *Id.* (citing Ex. 1002 ¶¶ 92–93).

In its Preliminary Response, Patent Owner averred that an express construction was not necessary for either of the terms "about 30±3 g/10 min" or "about 50." Prelim. Resp. 8–9. Patent Owner did, however, accept and apply Petitioner's proffered "construction of 'unstable endgroups' as including not only the four exemplary endgroups listed in the '609 patent, but *all* unstable endgroups resulting from any FEP process." *Id.* at 9–10 (emphasis added).

In our Institution Decision, we considered the evidence and the parties' mutually agreed-upon constructions to construe the term "unstable endgroups" to include "[all] unstable endgroups resulting from any FEP polymerization process." Dec. 4–5.

Petitioner, in its Reply, addresses the "unstable endgroups" construction as it was applied to the anticipation and obviousness challenges, expressing concern that our construction included "all" endgroups, regardless of the actual synthesis conditions employed in the relied-upon Examples and Comparative Examples. Reply 1, 14–16; Pet. 45–47; Dec. 18–19. Petitioner argues that the skilled artisan would not "speculate about ***unused*** synthesis conditions, and neither should the Board." Reply 1. Specifically, Petitioner argues that Patent Owner "now concedes" that "this all-endgroups requirement is wrong," because one of ordinary skill in the art "would not speculate about synthesis conditions that are not actually used." *Id.* at 14–15; *see also* Tr. 13:18–19 ("We never used the word 'all,' it was brought in through Chemours' arguments in the POPR."). Petitioner further argues that Patent Owner's Declarant "accounts for only four unstable endgroups" in her analysis of a product relied on by Patent Owner to demonstrate commercial success and "ignores others" because they would not be expected to result in the product based on its synthesis. Reply 4 (quoting Ex. 2006 ¶ 85). Petitioner contends Patent Owner's Declarant "concedes that unstable endgroups do not spontaneously appear." *Id.* at 4–5 (citing Ex. 1038, 162:11–23). Petitioner also avers the '609 patent does not support "an all-endgroups requirement" because, for example, it "omits ethyl groups." *Id.* at 5. Thus, according to Petitioner, it is "unreasonable to construe 'unstable endgroups' to require accounting of all known endgroups, even ones unexpected based on the synthesis used." *Id.*

During the oral hearing, Petitioner repeated its disagreement with the claim construction adopted in the Institution Decision as it was applied to certain challenges. Tr. 6:19–17:19. Petitioner agreed, however, that the claim construction set forth in the Institution Decision is correct as long as the references are not "criticized for not identifying end groups that would be unexpected or impossible to form." *Id.* at 14:8–14; *see also id.* at 16:20–17:8 (asserting "all we want to make sure is it's clear that the claim construction only requires the prior art to show end groups that possibly—that would be possible or expected by a person of skill in the art.").

Given that claim terms are interpreted in view of the knowledge of one of ordinary skill in the art at the time of the invention, we see no reason to modify our earlier construction. On the record now before us, and using the applicable standard of broadest reasonable interpretation, we maintain our construction of "unstable endgroups" to include "[all] unstable endgroups resulting from any FEP polymerization process." Dec. 4–5.

On the complete record, we determine that it is not necessary to provide an express construction for any other claim term for purposes of resolving the controversy. *See, e.g.*, *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011) ("[C]laim terms need only be construed 'to the extent necessary to resolve the controversy.'") (quoting *Vivid Techs., Inc.*, 200 F.3d at 803).

B. Level of Ordinary Skill in the Art

Petitioner's declarant, Dr. Iezzi, asserts that one of ordinary skill in the art

> would have a bachelor's degree or the equivalent training or experience in engineering, chemistry, materials science, or a related field and at least

> three years of experience relating to research and development of melt-processable fluoropolymers, including extrusion thereof, or a master's degree or the equivalent training or experience in engineering, chemistry, materials science, or a related field and at least one years of experience relating to research and development of melt-processable fluoropolymers, including extrusion thereof.

Ex. 1002 ¶ 25.

Patent Owner does not appear to dispute Dr. Iezzi's definition of one of ordinary skill in the art. *See generally* PO Resp. Neither party argues that the outcome of this case would differ based on our adoption of any particular definition of one of ordinary skill in the art. In light of the record now before us, we adopt Dr. Iezzi's definition of one of ordinary skill in the art. The level of ordinary skill in the art is also reflected by the references themselves. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) ("[T]he absence of specific findings on the level of skill in the art does not give rise to reversible error 'where the prior art itself reflects an appropriate level and a need for testimony is not shown.'"); *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (finding that the Board of Patent Appeals and Interferences did not err in concluding that the level of ordinary skill in the art was best determined by the references of record).

C. Overview of the Asserted References

1. Hiraga

Hiraga discloses methods of modifying a fluoropolymer via a melt-kneading process. Ex. 1025, 1 at code (57). Hiraga discloses that the modification method efficiently stabilizes unstable groups contained on the melt-processable fluoropolymer, homogenizes and prevents a decrease in the fluoropolymer's molecular weight, and increases the fluoropolymer's processability, thus enabling the production of "a molded article free of air bubbles and coloration." *Id.* ¶ 11.

Hiraga's method "may be applied to any melt-processable fluorine-containing polymer having unstable groups, but is particularly effective as a stabilization treatment for the unstable groups of" copolymers containing "tetrafluoroethylene (TFE) [and] hexafluoropropylene (HFP)," such as FEP polymers. *Id.* ¶¶ 19, 26. According to Hiraga, unstable groups include vinyl end groups ($–CF=CF_2$) and acid fluoride end groups (–COF), and may cause bubbles and cavities to form in the final product. *Id.* ¶ 3.

To achieve "the most homogeneous molecular weight possible, and not simply stabilize the unstable groups," Hiraga teaches that it is important "that water is not present" during the first step, i.e., "step (A)," "in which the treatment with oxygen-containing gas is carried out." *Id.* ¶ 30. Because the fluoropolymer's unstable groups cannot be stabilized in the presence of oxygen alone, however, the fluoropolymer "is melt-kneaded in the presence of oxygen while further aggressively introducing water, thereby both stabilizing the unstable groups and also oxidizing to remove coloration substances (step (B))." *Id.* ¶ 41. Hiraga discloses that a reaction accelerator may be added before or during either step A or step B, and that such reaction accelerators may be a compound containing an alkaline metal, an alkaline earth metal, an ammonium salt, ammonia, an alcohol, an amine, or a salt thereof. *Id.* ¶¶ 48–49.

Hiraga discloses Example 1 and Comparative Example 1 wherein the modified FEP polymer of Example 1 containing 15 ppm potassium was processed to yield a FEP copolymer with a melt flow rate of 30.0 g/10 min, and zero unstable groups per 10^6 carbons. *Id.* ¶¶ 107, 114–117.

2. Kaulbach

Kaulbach discloses "melt-processable tetrafluoroethylene (TFE)/hexafluoropropylene (HFP) copolymer melt pellets having an improved processability for wire and cable application" and "a method of using this polymer to coat wire and cable conductors." Ex. 1009, 1:9–13.

Kaulbach teaches that metal contaminants may "result in degradation and decomposition of the copolymer at high processing temperatures, which may in turn cause "a build up of die drools." *Id.* at 2:4–8. According to Kaulbach, "[d]ie drools are accumulations of molecular fractions of the polymer at the surface of the die exit" and "impair the coating processing." *Id.* at 2:8–10.

To assist with this and other potential problems, Kaulbach instructs that the copolymer "should be made more thermally stable not only by eliminating the thermally unstable endgroups but also by avoiding metal contaminants." *Id.* at 2:27–29. Kaulbach states that the polymer "material is essentially of high purity grade as to metals; that is the total amount of iron, chromium, [and] nickel is less than 200 parts per billion (ppb), preferably less than 100 ppb." *Id.* at 3:24–32. Kaulbach states that "[i]t is believed that metal contaminants, in particular heavy metals like Fe, Ni, [and] Cr might induce a decomposition reaction," and by using material that contains "only less than 50 ppb of Fe+Ni+Cr ions," "the material according to the invention can be called a high purity grade." *Id.* at 4:21–24.

Kaulbach discloses that the manufacturing process for preparing the polymer may include polymerization, coagulation, agglomeration, fluorination, and pelletizing. *Id.* at 4:25–6:30.

Kaulbach discloses that "[t]he polymerization may be carried out in form of a radical emulsion polymerization as it is known in the art," and that initiators such as ammonium or potassium persulfate may be used, along with emulsifiers such as "the ammonium salt of perfluoro-octanoic acid" and buffers such as "NH_3, $(NH_4)_2CO_3$ or $NaHCO_3$" in the polymerization recipe. *Id.* at 4:27–34. Kaulbach discloses that a "preferred version of the polymerization recipe here is an alkali metal salt-free recipe." *Id.* at 4:44–45.

Regarding coagulation, Kaulbach states that mechanical coagulation is preferred over chemical coagulation because chemical coagulation "is generally done with acids" which is "not preferred as it results in very high levels of metal contaminants at all subsequent work up steps." *Id.* at 5:3–17.

Kaulbach seeks to minimize introducing metal contamination during fluorination by ensuring the "agglomerate is soft enough to not scratch off metal contaminants from the wall of the tumble drier." *Id.* at 5:46–48. Kaulbach also instructs that "[m]elt-pelletizing fluorinated agglomerates provides many advantages compared to the melt pelletizing of non fluorinated agglomerates"—one of which is substantially reducing equipment corrosion that results in an insignificant "pick up of metal contamination." *Id.* at 6:1–8.

Kaulbach states that "[h]igh processing speeds are desired when wires and cables are extrusion coated" and that "[t]o increase the extrusion speed the molecular weight distribution of the used copolymer is believed to be very broad . . . for FEP" copolymers. *Id.* at 1:29–36. Kaulbach notes that "according to conventional wisdom," FEP mixtures that "have a very broad molecular weight distribution which . . . results in [] improved extrudability." *Id.* at 1:56–59. Kaulbach's inventive polymers purport to have "a very narrow molecular-weight distribution, i.e., a ratio of Mw to Mn of less than about 2 (Mw=weight average, Mn=number average molecular weight)," which "may be as low as 1.5," and "is in contrast to FEP-grades recommended for wire coatings with high extrudation rates where a broad molecular weight distribution is recommended." *Id.* at 3:34–41. Kaulbach states that "the art teaches that a broad molecular weight distribution is needed to achieve such high processing rates," but that "[i]t has now been discovered that a narrow molecular weight distribution performs better, thus overcoming a well established prejudice." *Id.* at 3:61–65.

Kaulbach discloses that, "[f]or high speed wire extrusion[,] the MFI [melt flow index] of the polymer is ≥ 15." *Id.* at 3:43–44. Kaulbach discloses several example copolymers. One is "[a] melt pelletized copolymer [] with a MFI-value of 24 [g/10 min] and containing 15% HFP" which "can be extruded with a wire coating extruder at . . . a rate of 1500 feet/min over a run time of the equipment of 6 hours without exhibiting discoloration and without producing substantial amounts of die drools and with fewer cone-breaks in contrast to commercial FEP grades." *Id.* at 3:49–56. Another example copolymer—Sample A11—exhibited a MFI value of 24 g/10 min and had a measured molecular weight distribution value of 1.6. *Id.* at 8:55–65.

3. Kono

Kono discloses pellets that comprise "a copolymer obtained by copolymerizing monomer components containing tetrafluoroethylene (TFE) and hexafluoropropylene (HFP)," also known as a "FEP pellet." Ex. 1008, 3:32–36. Kono discloses that the inventive FEP pellet is used in a coating extrusion process for insulating a core wire, i.e., the "FEP pellet is melted by heating within an extruder for coating a core wire and extrud[ing] from a die, and then draw[ing] down by coating the core wire to thereby form an insulated cable." *Id.* at 4:29–34.

Kono discloses that the extrusion process with the inventive FEP pellet can be carried out at a speed of 2800 ft/min when the adhesive strength between the insulating material and the core wire is 0.8 kg or more. *Id.* at 4:42–50. Kono hypothesizes that the "excellent adhesive strength" exhibited by the inventive FEP pellets when extruded may be due to the presence of a certain functional group, also known as an "adhesion factor" or, if the adhesion factor is located at end of the polymer, as an "adhesion terminus." *Id.* at 5:1–9. Kono teaches that the adhesion terminus is "not particularly limited as long as it contributes to enhanced adhesion with the core wire at high temperature, and includes, for example, a functional group which is generally known to be unstable at high temperature." *Id.* at 5:14–18. Kono identifies several such known functional groups, including –COOM, $–SO_3M$, $–OSO_3M$, $–SO_2F$, $–SO_2Cl$, –COF, $–CH_2OH$, $–CONH_2$, and $–CF{=}CF_2$, where M is selected from an alkyl group, a hydrogen atom, a metallic cation and a quaternary ammonium cation. *Id.* at 5:18–22. Kono discloses that the number of functional groups located at the terminal portion of the polymer depends on a number of factors, including the polymer's melt flow rate and the monomers present therein. *Id.* at 5:23–27.

Kono discloses example pelletized FEP powders where, *inter alia*, the number of certain functional groups (i.e., "adhesion terminus" groups) per 10^6 carbon atoms were measured. *Id.* at 12:11–16:47. The "adhesion terminus" groups measured for Kono's Examples 1–7 and Kono's Comparative Examples 1–5 were limited to –COF, –COOH, and $–CH_2OH$. *Id.* at 15:1–18:20.

D. Analysis

To anticipate a claim under 35 U.S.C. § 102, "a single prior art reference must expressly or inherently disclose each claim limitation." *Finisar Corp. v. DirecTV Grp., Inc.*, 523 F.3d 1323, 1334 (Fed. Cir. 2008). Accordingly, "the dispositive question regarding anticipation [i]s whether one skilled in the art would reasonably understand or infer from the [prior art reference's] teaching" that every claim element was disclosed in that single reference. *Dayco*

Prods., Inc. v. Total Containment, Inc., 329 F.3d 1358, 1368 (Fed. Cir. 2003).

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious to a person of ordinary skill in the art at the time the invention was made. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). Obviousness is resolved based on underlying factual determinations, including: (1) the scope and content of the prior art; (2) differences between the prior art and the claims at issue; (3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness, i.e., secondary considerations. *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). Secondary considerations may include the following: "commercial success, long-felt but unmet needs, failure of others, etc." *Id.* The totality of the evidence submitted may show that the challenged claims would not have been obvious to one of ordinary skill in the art. *In re Piasecki*, 745 F.2d 1468, 1471–72 (Fed. Cir. 1984).

Petitioner bears the burden of proving unpatentability of the challenged claims, and the burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). Petitioner must demonstrate unpatentability by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d); *see also Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim")). A party that petitions the Board for a determination of obviousness must show that "a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success in doing so." *Procter & Gamble Co. v. Teva Pharm. USA, Inc.*, 566 F.3d 989, 994 (Fed. Cir. 2009) (quoting *Pfizer, Inc. v. Apotex, Inc.*, 408 F.3d 1348, 1361 (Fed. Cir. 2007)).

1. Asserted Anticipation Based on Hiraga (Ground 1)

Petitioner asserts that claims 1–7 are unpatentable as anticipated under 35 U.S.C. § 102(a) in view of Hiraga. Pet. 25–35. Petitioner asserts that Hiraga "discloses FEP-copolymers that anticipate the challenged claims." *Id.* at 25. Petitioner provides a detailed explanation alleging where each limitation of the claims can be found in Hiraga. *Id.* at 26–35 (citing Ex. 1002 ¶¶ 110–147). Patent Owner, in its Response, presents no arguments specifically directed to Petitioner's Ground 1. *See generally* PO Resp. Petitioner's Reply reiterates its arguments that Hiraga discloses the unstable endgroups expected from its synthesis (Reply 3) and that Hiraga adds potassium to an already-isolated FEP (*id.* at 6).

Claim 1 requires a FEP "polymerized and isolated in the absence of added alkali metal salt." Ex. 1001, 10:19–20. It does not appear to be disputed that Hiraga's Example 1 and Comparative Example 1 ("Example 1C") had an alkali metal (potassium) concentration of 15 ppm. Ex. 1025 ¶¶ 107, 114. Petitioner argues that one of ordinary skill "would have associated the alkali metal's presence in these examples with endgroup stabilization, and not polymerization or isolation." Pet. 28 (citing Ex. 1002 ¶¶ 121–122). Petitioner concludes that, because "Hiraga is silent regarding the addition of alkali metal salts in the polymerization and isolation of Comparative Example 1, and endgroup stabilization is not within the scope of the term 'polymerized and isolated,'" Comparative Example 1 meets this claim limitation. *Id.* at 29. In our Institution Decision, we considered whether Hiraga's Example 1C included 15 ppm potassium before any endgroup stabilization, meaning that the potassium would have had to be added either during polymerization or isolation. Dec. 9. We also considered whether Hiraga disclosed that an alkali metal can be added to the FEP in advance of any finishing steps as a reaction accelerator. *Id.* Petitioner replies: "Adding potassium in those steps [either polymerization or isolation] makes zero sense." Reply 7. We note Petitioner's reliance on the testimony of Patent Owner's declarant Dr. Mecham, in which she could not conclude whether Hiraga adds potassium during either polymerization or isolation. *Id.* (citing Ex. 1038, 115:17–116:6, 118:16–119:18). This testimony, however, reinforces that it is unclear from Hiraga that the FEP is polymerized and isolated in the absence of added alkali metal salt, despite Petitioner's assertions that one of ordinary skill in the art "would understand that, in Examples 1 and 1C, Hiraga adds potassium after isolation but before step (A)." Reply 8. To anticipate a claim, a prior art reference must disclose every limitation of the claimed invention, either expressly or inherently. *Blue Calypso, LLC v. Groupon, Inc.*, 815

F.3d 1331, 1341 (Fed. Cir. 2016). "To establish that a prior art reference inherently—rather than expressly—discloses a claim limitation, 'the limitation at issue necessarily must be present, or [is] the natural result of the combination of elements explicitly disclosed by the prior art.'" *Endo Pharm. Sols., Inc. v. Custopharm Inc.*, 894 F.3d 1374, 1381 (Fed. Cir. 2018) (alteration in original) (quoting *Par Pharm., Inc. v. TWI Pharm., Inc.*, 773 F.3d 1186, 1196 (Fed. Cir. 2014)).

> Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing *may* result from a given set of circumstances is not sufficient. [Citations omitted.] If, however, the disclosure is sufficient to show that the natural result flowing from the operation as taught would result in the performance of the questioned function, it seems to be well settled that the disclosure should be regarded as sufficient.

Cont'l Can Co. USA, Inc. v. Monsanto Co., 948 F.2d 1264, 1269 (Fed. Cir. 1991) (alteration in original) (quoting *In re Oelrich*, 666 F.2d 578, 581 (CCPA 1981)). Petitioner's argument on this point does not appear to be based on an express disclosure that Hiraga's process polymerizes and isolates in the absence of added alkali metal salt. Rather, Petitioner argues that one of ordinary skill in the art would understand when potassium was added in Hiraga's process. Reply 8.

On this complete record, we find Petitioner has not demonstrated that the FEP in Hiraga necessarily is polymerized and isolated in the absence of added alkali metal salt. Particularly in the context of an anticipation ground, we cannot take Hiraga's silence regarding the inclusion of a component (an alkali metal salt), which is required to be absent per the claims, as a clear representation that the component is in fact absent, because the presence of 15 ppm potassium and the reaction accelerator conditions described in Hiraga indicate that the polymerization and isolation may take place in the presence of an alkali metal.

Claim 1 also requires a copolymer "having no more than about 50 unstable endgroups/10^6 carbon atoms." Ex. 1001, 10:20–21. We refer to Petitioner's claim construction of the term "unstable endgroups" (Pet. 24), and the claim construction that we adopted based on the apparently mutual agreement of the parties, namely, that the term "unstable endgroups" includes not only those unstable endgroups exemplified in the '609 patent, but "[all] unstable endgroups resulting from any FEP polymerization process."

We find that the FEPs disclosed in Hiraga's Examples 1 and 1C do not necessarily have fewer than about 50 unstable endgroups per million carbon atoms. Petitioner cites to Hiraga's disclosure that one copolymer (Table 1, row 3) had 0 unstable endgroups per 10^6 carbons. Pet. 31. However, it is unclear from the disclosure of Hiraga which endgroups were actually measured. As noted in our Institution Decision, Hiraga's disclosure of "zero" unstable endgroups per million (i.e., 10^6) carbon atoms does not identify the types of unstable endgroups that are measured. Dec. 10–11; Ex. 1025 ¶ 112. All unstable endgroups could include ethyl groups ($–CF_2CH_2CH_3$).

Ex. 1002 ¶ 93; Ex. 1035 ¶ 2.6; *see also* Ex. 1008, 5:14–22 (reciting various known terminal functional groups that are "unstable at high temperature"); Ex. 1010, 5:38–39 ("[t]he presence of methanol can also lead to methyl ester ends (-CO_2CH_3)"); Ex. 1025 ¶¶ 3, 34, 44 (identifying a vinyl group (–$CF{=}CF_2$) along with carboxylic acid (–COOH) and acid fluoride (–COF) groups as unstable groups). Petitioner's reliance on Hiraga's disclosure of 0 unstable endgroups per million carbon atoms is insufficient to establish that Hiraga discloses "no more than about 50" of *all* possible unstable endgroups resulting from any FEP polymerization process per our construction of this limitation. Hiraga does not measure all possible unstable groups, and under that application of our claim construction, falls short of anticipating this limitation of claim 1.

Even under a more liberal application of our claim construction, looking only at endgroups that might be present based on Hiraga's synthesis conditions, Petitioner does not meet its burden. Hiraga's Examples 1 and 1C do not state which endgroups they measure. Ex. 1025 ¶¶ 112, 117. Hiraga discloses that "examples of unstable groups include" –COOH, –$CF{=}CF_2$, and –COF, but the words "examples of" and "include" indicate this is not necessarily a closed set. *Id.* ¶ 44. We also are not persuaded that the examples of unstable endgroups provided by Hiraga (i.e. –COOH, –$CF{=}CF_2$, and –COF,) signify that those are the only unstable endgroups that would be expected to form under Hiraga's reaction conditions. Even if we credited Dr. Iezzi's opinion that only –COOH and –COF endgroups would form as a result of Hiraga's synthesis conditions (Pet. 30 n.7 (citing Ex. 1002

¶ 98)), we are not persuaded that Hiraga's disclosure (1) is in agreement with this opinion, as it provides examples of other unstable endgroups; (2) requires that these are the only unstable endgroups that would need to be measured; or (3) in fact measures those endgroups.

On this complete record, Petitioner fails to provide sufficient evidence to establish that Hiraga discloses a FEP polymer with the recited number of unstable endgroups, i.e., "no more than about 50 unstable endgroups/10^6 carbon atoms." For the reasons given, Petitioner fails to establish by a preponderance of the evidence that Hiraga anticipates claims 1–7.

2. Asserted Obviousness Based on Hiraga Alone (Ground 2)

Petitioner asserts that Hiraga alone renders claims 1–7 of the '609 patent obvious under 35 U.S.C. § 103(a). Pet. 35–38. Petitioner asserts that the skilled artisan would have found it obvious to substitute Hiraga's melt-kneading process with an alternative fluorination process, "or to use melt-kneading only to adjust the [melt flow rate] of the copolymer and separately remove unstable endgroups using fluorination." *Id.* at 37 (citing Ex. 1002 ¶¶ 154–157). Petitioner further asserts that the skilled artisan would have been motivated to use such a fluorination process in Hiraga "for many reasons," including because the skilled artisan would have understood that fluorination is "an alkali-metal-free stabilization method," and also "provides benefits compared to other stabilization techniques, such as Hiraga's wet-heat treatment." *Id.* at 37–38 (citing Ex. 1002 ¶ 155–156). Petitioner points to evidence that purportedly demonstrates fluoropolymers containing endgroups that are stabilized via a fluorination process have "better electrical properties than those untreated or treated using different means." *Id.* at 38 (citing Ex. 1027 ("Piekarski"), 3:34–39).

Petitioner first asserts that the skilled artisan would have replaced both of Hiraga's melt-kneading steps (A) and (B) with fluorination. *Id.* at 37. We note Petitioner's acknowledgment that Hiraga's step (A) "narrows the FEP's molecular weight distribution by melt-kneading in the presence of heat and oxygen to homogenize molecular weight," and step (B) "then stabilizes the FEP by melt-kneading with heat, oxygen, and water." Reply 7. Hiraga is not only concerned with stabilizing unstable endgroups of a fluoropolymer, but also seeks to tailor the polymer's molecular weight. *See* Ex. 1025 ¶ 30 ("The object of the present invention is to adjust the molecular weight and create a polymer with the most homogeneous molecular weight possible, and not simply stabilize the unstable groups.").

Petitioner, however, has not shown that substituting both melt-kneading steps (A) and (B) with a fluorination step alone would have had any impact on a fluoropolymer's molecular weight, and consequently, its Melt Flow Rate ("MFR"). Pet. 35–38; Reply 6–8. Petitioner acknowledges, and provides record evidence establishing, that a fluoropolymer's molecular weight is inversely related to its MFR. Pet. 9 ("MFR is inversely related to melt viscosity and also molecular weight. Ex. 1009, 6:33–35; Ex. 1006, 3:21–27; Ex. 1002, ¶ 50."); Dec. 12.

Thus, on this record, it remains unclear what impact—if any—a fluorination process alone would have on the MFR of Hiraga's Comparative Example 1 polymer. Pet. 32–33. Hiraga's Comparative Example 1 has a MFR prior to melt kneading of 25 g/10 min, which is outside of the range of "about 30±3 g/10 min" recited in claims 1–7. Ex. 1025 ¶¶ 107, 114, 117. Without evidence as to how fluorination alone would impact the MFR, we are unpersuaded that applying fluorination without any melt-kneading to Hiraga's Comparative Example 1 would result in a fluoropolymer with a melt flow rate of "about 30±3 g/10 min." Thus, Petitioner's first proffered basis for modifying Hiraga—replacing both melt-kneading steps (A) and (B) with fluorination alone (Pet. 37)—lacks persuasive merit.

Second, Petitioner contends that the skilled artisan would have found it obvious to first melt-knead Hiraga's Comparative Example 1 polymer in step (A), then stabilize the polymer's unstable endgroups by fluorination instead of melt-kneading the polymer in step (B). Pet. 37–38 (citing Ex. 1002 ¶ 155–156). In the testimony relied upon by Petitioner, Dr. Iezzi refers to Kaulbach as leading one of ordinary skill in the art to understand and appreciate the importance of minimizing the presence of alkali metals in fluoropolymers. *Id.* (citing Ex. 1002 ¶ 155). As we discuss in more detail below, we are not persuaded that the skilled artisan would have viewed alkali metal salts—such as those that may be intentionally added during polymerization (Ex. 1009, 4:27–34), or used to stabilize unstable endgroups of a polymer (Ex. 1025 ¶¶ 17, 48)—as a contaminant to be avoided. Furthermore, Hiraga itself does not treat alkali metals as contaminants to be avoided, but rather intentionally adds them as preferred accelerators of the stabilization reaction. Ex. 1025 ¶ 17.

Third, Petitioner argues that the skilled artisan would have been motivated to substitute Hiraga's wet-heat method of stabilizing the fluoropolymer at step (B) with a fluorination process because "fluorination provides benefits compared to other stabilization techniques, such as Hiraga's wet-heat treatment." Pet. 38. Petitioner points to evidence of record that purportedly demonstrates that "fluoropolymers with endgroups stabilized using fluorination have better electrical properties than those [] treated using different means." *Id.* (citing Ex. 1027, 2:6–11, 3:34–39, 3:53–54). Specifically, Petitioner avers "that functional endgroups, like $–CF_2H$ groups that are formed during wet-heat stabilization,[4] are responsible for dielectric loss at high frequencies leading to poorer electrical properties." *Id.*

We are not persuaded, however, that this disclosure would have motivated the skilled artisan to eliminate Hiraga's melt-kneading stabilization step, and completely replace it with a fluorination process to stabilize the unstable endgroups. We note that Petitioner tries to make a case here that the patent would have been obvious based on Hiraga alone, but to make its case, relies (indirectly) upon the teachings of Piekarski, which discloses several methods for improving the dissipation factor of FEP copolymers,

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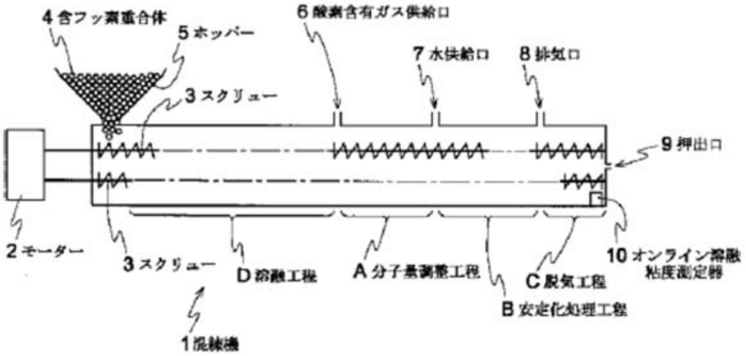
[4] See Ex. 1025 ¶ 4 (explaining that unstable end groups can be "treated in the presence of water and heat and thus are converted to stable $–CF_2H$ groups").

both at high and low frequencies. *Id.* (citing Ex. 1027, 2:6–11, 3:34–39, 3:53–54).

In our view, however, Petitioner's reliance on Piekarski's disclosure does not explain sufficiently how such omission of Hiraga's melt-kneading stabilization step could have been accomplished because, in Comparative Example 1, molecular weight adjustment and endgroup stabilization are being carried out *simultaneously* by melt-kneading. Ex. 1025 ¶¶ 107–118. Specifically, Hiraga explains that the twin screw extruder used as the melt-kneader has several zones, including "molecular weight adjustment zone (A)" and "stabilization treatment zone (B)." *Id.* ¶ 108. Hiraga's extruder is depicted in Figure 1:

FIG. 1



Hiraga's Figure 1 "is a schematic cross-sectional view of an extruder," 1, containing motor 2, screw 3, fluorine-containing polymer 4, hopper 5, oxygen-containing gas supply port 6, water supply port 7, exhaust port 8, extrusion port 9, molecular weight adjustment zone A, stabilization zone B, deaeration zone C, and melt zone D. *Id.* ¶ 120, Fig. 1.

Hiraga explains that molecular weight adjustment, i.e., step (A), is first carried out by melt-kneading the fluorine-containing polymer "in the presence of an oxygen-containing gas such as air." *Id.* ¶ 30. In Hiraga's Figure 1, the oxygen-containing gas supply port 6 is situated at the beginning of molecular weight adjustment zone A. *Id.* at Fig. 1. Hiraga further instructs that "unstable groups of the fluorine-containing polymer cannot be stabilized by the presence of the oxygen alone and, as such, . . . the fluorine-containing polymer is melt-kneaded in the presence of oxygen while further aggressively introducing water." *Id.* ¶ 41. Water supply port 7 is situated between molecular weight adjustment zone A and stabilization treatment zone B. *Id.* at Fig. 1. In Comparative Example 1, Zones A and B "were not partitioned," were at the same temperature, and the air and water were simultaneously supplied. *Id.* ¶ 114. Based on this disclosure, it is not clear how Petitioner's proffered modification of Hiraga's Comparative Example 1 could have been carried out, because the lack of partitioning would render difficult if not impossible Petitioner's proposed modification involving only the process carried out in zone B.

Moreover, the evidence upon which Petitioner indirectly relies appears to allow for up to 50 endgroups per million carbon atoms other than $-CF_3$ in the copolymer to achieve the purported improvement in electrical properties. Pet. 38; Ex. 1027, 3:42–43. On the fully developed record, however, Petitioner has not provided sufficient evidence that establishes Hiraga's Comparative Example 1—after molecular weight adjustment step

(A)—has 50 or more terminal groups other than $-CF_3$.[5] In fact, Hiraga does not measure Comparative Example 1's endgroups in this manner, but rather focuses on *unstable* endgroups, and appears to measure those endgroups only *after* the stabilization process is complete. Ex. 1025 ¶¶ 115–117.

Even if Petitioner provided such evidence, however, Hiraga already teaches the possibility of fluorination after stabilization via melt-kneading. Ex. 1025 ¶ 50; Ex. 1027, 3:34–43. Thus, on the fully developed record before us, Petitioner has not established that the skilled artisan would have been motivated to completely eliminate Hiraga's stabilization via melt-kneading at step (B) in favor of a fluorination step that Hiraga already teaches may be carried out *after* both melt-kneading steps (A) and (B). Ex. 1025 ¶ 50. It follows that we are not persuaded that the skilled artisan would have been motivated to eliminate the alkali metal salt used in Hiraga's melt-kneading stabilization step (B)[6] to yield a FEP polymer with an alkali metal ion concentration falling within the ranges recited in claims 1–7 of the '609 patent.

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[5] The $-CF_2H$ endgroups at issue in this challenge are repeatedly referred to in the record as "stable" or "highly stable." Pet. 11; Ex. 1007, 2:65–67, 3:4–5, 5:10; Ex. 1010, 5:37–38, 5:44–46; Ex. 1025 ¶ 4; Ex. 2017, 3:30–33; Ex. 1002 ¶ 60. Piekarski discloses that another type of stable endgroup, $-CF_3$, is desired, and therefore seeks to limit the total amount of *any* other endgroup, including stable $-CF_2H$ groups, to a value of less than 50 per million carbon atoms. Ex. 1027, 3:34–43, 3:53–54.

[6] Hiraga adds alkali metal salts as a catalyst during stabilization via melt-kneading. Ex. 1025 ¶¶ 17, 48, 63; *see also* Ex. 2010, 43:6–20, 45:19–46:2 (Dr. Iezzi testifying that alkali metal salts in Hiraga are added during polymer stabilization).

Therefore, Petitioner has not established that claims 1–7 of the ’609 patent are unpatentable over Hiraga alone.

3. Asserted Obviousness Based on Hiraga and Kaulbach (Ground 2)

Petitioner asserts that claims 1–7 are unpatentable under 35 U.S.C. § 103(a) as obvious over the combined disclosures of Hiraga and Kaulbach. Pet. 35–38.

Petitioner specifically points to Hiraga’s Comparative Example 1, which “employs melt-kneading to remove unstable endgroups from a fluoropolymer that was blended with an alkali metal after polymerization and isolation.” *Id.* at 35–36. Petitioner then turns to Kaulbach’s disclosure regarding certain benefits that may be realized by avoiding metal contamination, specifically alkali metal contamination, when processing melt-processable FEP. *Id.* at 36–37.

Petitioner asserts that the skilled artisan, armed with the teachings of Kaulbach, “would have been motivated to avoid using alkali metals in Hiraga’s Comparative Example 1, and would have employed one of the other reaction accelerators Hiraga discloses.” *Id.* at 36. Petitioner urges that “[d]oing so would result in a final copolymer made without the addition of alkali metal salt,” thus rendering claims 1–7 obvious. *Id.* Petitioner asserts further that the disclosures of Hiraga and Kaulbach are properly combinable because the references are “directed to the same technology and seek to obtain the same benefits,” and also focus on preparing “copolymers of high MFR that are stabilized to remove unstable endgroups.” *Id.* As such, the skilled artisan, upon considering Hiraga’s examples, "would have logically looked to Kaulbach for ways to further improve the melt-processability of the copolymer," and would have reasonably expected "improved processability and low incidences of flaws" in a FEP copolymer by avoiding metal contamination as taught by Kaulbach. *Id.* at 37. Alternatively, Petitioner argues that it would have been obvious to one of ordinary skill in the art to use fluorination in place of Hiraga's melt-kneading process, because fluorination is an alkali-metal-free stabilization method, and because fluorination provides benefits compared to other stabilization techniques. *Id.* at 37–38.

Patent Owner argues that "Kaulbach does not teach any reason to avoid alkali metal salt." PO Resp. 15. More particularly, Patent Owner argues that Kaulbach is directed to reducing metal contaminants, not alkali metal salts. *Id.* at 16. For example, Patent Owner argues, "Kaulbach is specifically concerned with reducing the concentration of heavy metals, such as iron, nickel, and chromium" that are "found in the processing equipment used for FEP polymerization and stabilization." *Id.* (citing Ex. 2006 ¶¶ 45–46; Ex. 1009, 3:29–32). Patent Owner further argues: "Alkali metals are different from heavy metals." *Id.* at 17 (citing Ex. 2006 ¶ 46; Ex. 2010, 51:21–22). Kaulbach, in Patent Owner's estimation, does not teach reducing or eliminating alkali metal salt from the final copolymer. *Id.* at 19. Kaulbach's statements regarding the preferred version of the polymerization recipe being an alkali metal salt free recipe, according to Patent Owner, are agnostic about whether or not alkali metal salts can be added during coagulation of the polymer or stabilization of the polymer. *Id.* at 20 (citing Ex. 1009, 4:45–46; Ex. 2010, 57:15–58:6; Ex. 2006 ¶¶ 48–50).

We disagree that Kaulbach treats all types of metals as "contaminants" as alleged by Petitioner. Rather, despite the commonality of the word "metal," Kaulbach distinguishes between (1) heavy metal "contaminants" and (2) alkali metal salts which may be purposefully added during FEP synthesis. Ex. 1009, 4:18–20, 4:45–46.

Regarding heavy metal contaminants, Kaulbach discusses corrosion of the FEP-polymer processing equipment, which undisputedly is not made of alkali metals. *See* Ex. 2006 ¶ 46 (Dr. Mecham explaining that "processing equipment typically used in FEP synthesis and extrusion is made of corrosion-resistant metal alloys that typically contain high levels of nickel," a heavy metal, and not alkali metals due to "their high reactivity and physical characteristics"); Ex. 2010, 50:17–19 (Dr. Iezzi agreeing that processing equipment is not made of alkali metals). In that regard, Kaulbach states that "[m]elt pelletizing of unstabilized polymer resins results in corrosion of the equipment used in the process and in metal contamination of the melt pellets," and further notes that a stabilization process that uses water steam "is very difficult to manage due to corrosion of the equipment." Ex. 1009, 1:65–2:3.

Kaulbach also notes that "excessive metal contamination should be avoided" during fluorination of the agglomerate. *Id.* at 2:39–40. Kaulbach explains: "The fluorination is carried out in a tumble drier to keep the material in motion," and the "agglomerate is soft enough to not scratch off metal contaminants from the wall of the tumble drier. Thus the level of metal contaminants is reduced." *Id.* at 5:35–36, 5:46–48; *see also id.* at 5:53–58 (explaining that during the fluorination, "hard and sharp melt pellets scratch off a considerable amount of metal from the wall of the tumble drier," "[i]ncreasing reaction times result in higher metal contamination" that "is difficult to remove," and "[t]he level of metal contamination was observed to increase by up to 2 orders of magnitude[] when the pellet process was used."). In discussing the advantages of melt pelletizing fluorinated agglomerates over non-fluorinated agglomerates, Kaulbach notes one such advantage is that "[t]he corrosion of the equipment is substantially reduced. The pick up of metal contamination thus is insignificant." *Id.* at 6:1–8. Furthermore, in discussing an "aqueous treatment" step post-fluorination, Kaulbach notes that "the near-absence of gaseous decomposition chemicals and acidic endgroups reduce the corrosion of the stainless steel water treatment vessel considerably. Thus further heavy metal contamination is diminished." *Id.* at 6:23–27; *see also id.* at 5:14–17 (expressing a preference for non-acidic methods during the coagulation step because using acids "results in very high levels of metal contaminants at all subsequent work up steps"); Ex. 2010, 56:9–13 (Dr. Iezzi explaining that "[c]hemical coagulation is generally . . . not done with acids" and that Kaulbach "says it's generally not done with acids, and he does say it's not preferred because you could get high levels of metal contamination."); Ex. 2006 ¶ 49 (Dr. Mecham explaining that Kaulbach teaches to avoid acids during polymer coagulation "because acids can corrode the processing equipment, thereby leading to heavy metal contaminants in the polymer.").

Kaulbach furthermore specifically identifies a class of metals—"heavy metals"—as "metal contaminants," and then specifies three such heavy metals as iron, nickel, and chromium. Ex. 1009, 4:18–20; *see also id.* at 7:55–65 (identifying Fe, Ni, and Cr as "metal contaminations" for samples A0 and A1). The equipment used to process FEP polymers is "typically made of corrosion-resistant metal alloys with a high nickel content." Ex. 2006 ¶ 25 (citing Ex. 2019, 3–4). When referring to "the polymer of the invention" as "essentially of high purity grade as to metals," Kaulbach states that this means "the total amount of iron, chromium, [and] nickel is less than 200 parts per billion (ppb), preferably less than 100 ppb." Ex. 1009, 3:24–32.

Regarding alkali metal salts, Kaulbach indicates they have a different purpose than the heavy metals that Kaulbach seeks to avoid. Ex. 2010, 51:21–22; Ex. 2006 ¶ 46. Notably, Kaulbach discloses that an alkali metal salt, such as sodium bicarbonate buffer, can be intentionally added during FEP polymerization. Ex. 1009, 4:33–34. Dr. Iezzi acknowledges that intentionally added components would not be considered a "contaminant." Ex. 2010, 52:9–17.[7]

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[7] We observe that Dr. Iezzi's testimony on this point conflicts with Petitioner's counsel's representation of that testimony during the oral hearing. *Compare* Tr. 30:11–20 ("if you intentionally add a metal, it's a contaminant to the polymer" and "that's our expert's interpretation of Kaulbach") *with* Ex. 2010, 52:9–17 (alkali metal salts "wouldn't be a contamination if you purposely added it").

Kaulbach discloses a preference for an alkali metal salt-free polymerization recipe. Ex. 1009, 4:45–46. Quite significantly, however, Kaulbach does not indicate why such a recipe is preferred. *Id.*, *generally*. Furthermore, Petitioner's Declarant acknowledges there are more steps to FEP synthesis than the "polymerization" step, such as isolation (or "coagulation")[8], and stabilization. Ex. 2010, 42:2–43:17. Kaulbach is silent about avoiding or minimizing alkali metals during such FEP-synthesis steps post-polymerization. Ex. 1009, *generally*. The evidence of record establishes that alkali metal salts were known to be intentionally added—sometimes preferably—during the isolation and stabilization of fluorine-containing polymers such as FEP copolymers of tetrafluoroethylene (TFE) and hexafluoropropylene (HFP). Ex. 1025 ¶¶ 2, 3, 12, 17, 48, 49; Ex. 1026, 4:6–18; Ex. 2011, 6:1–5; *see also* Ex. 2006 ¶ 49 (Dr. Mecham testifying that "alkali metal salts were commonly used during chemical coagulation in the early 2000s"). Thus, Kaulbach's lack of direction to avoid alkali metal salts during the coagulation and stabilization steps of its FEP polymer supports Patent Owner's position that Kaulbach does not teach avoiding alkali metal salts altogether. It further supports Patent Owner's position that alkali metal salts, unlike heavy metals, are not considered "contaminants" by Kaulbach. PO Resp. 2, 16–18.

Based on these distinctions made by Kaulbach, we are not persuaded that alkali metal salts would have been understood by the skilled artisan to be a heavy

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[8] *See* Ex. 2006 ¶ 23 ("Coagulation . . . is one method of isolating a polymer").

metal "contaminant" that should be avoided. Accordingly, we are not persuaded by Petitioner's proffered rationale, inaccurately leveraging Kaulbach's use of the common term "metal" to conflate metal contaminants with alkali metal salts, for modifying Hiraga's Comparative Example 1 FEP to exclude alkali metal salt. *See* Pet. 36 ("Kaulbach touts the *benefits of an alkali-metal free process* by emphasizing that the *absence of metal contamination* in melt-processable FEP copolymers can prevent degradation and decomposition," thus the skilled artisan "would have been motivated to *avoid using alkali metal* in Hiraga's Comparative Example 1" (emphasis added)). Although Kaulbach discloses a "preferred" alkali metal salt-free polymerization recipe, Kaulbach does not explain precisely why that recipe is the preferred one, nor does it specify that alkali metal salts must be absent from every step of the polymerization process. Thus, Petitioner has not established that Kaulbach's disclosure would have motivated the skilled artisan to reduce or eliminate the presence of alkali metals during all steps of synthesizing Hiraga's Comparative Example 1 FEP.

For the reasons given above, we are not persuaded that Petitioner has established by a preponderance of the evidence that claims 1–7 of the '609 patent are unpatentable over Hiraga and Kaulbach.

4. Asserted Anticipation Based on Kono (Ground 3)

Petitioner asserts that claims 1–7 of the '609 patent are anticipated by Kono. Pet. 38–50.[9] Petitioner

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[9] We note that the Petition appeared to argue that only claims 1–5 and 7 are anticipated by Kono, and that claim 6 is only rendered

argues that Kono discloses "copolymers meeting each of the relevant claim limitations." Pet. 39. Petitioner provides a detailed explanation alleging where each limitation can be found in Kono for these claims. *Id.* at 40–50 (citing Ex. 1002 ¶¶ 159–197). Petitioner also expressed a concern that our Institution Decision applied our construction of "unstable endgroups" too restrictively by requiring certain references to account for endgroups that may not form under given synthesis conditions. Reply 14–15. Thus, we examine which endgroups would be "expected" or "possible" based on the specific synthesis conditions used.

Kono's Example 2 polymer has a total of 58 measured endgroups: 3 –COF groups, 2 –COOH groups, and 53 $-CH_2OH$ groups. Ex. 1008, Table 1. Kono's Comparative Example 3 polymer has a total of 50 measured endgroups: 3 –COF groups, 1 –COOH group, and 46 $-CH_2OH$ groups. *Id.* The polymers of Example 2 and Comparative Example 3 employ the use of methanol as a chain transfer agent "to adjust the molecular weight." *Id.* at 13:7–10, 14:20–25; 12:34–36. Petitioner's evidence establishes, however, that "[i]f a molecular weight modifier such as methanol is employed, then a portion of the ends may be carbinol ($-CH_2OH$) as well as the more stable difluoromethyl ends ($-CF_2H$). The *presence of methanol can also lead to methyl ester ends* ($-CO_2CH_3$)." Ex. 1010, 5:35–39 (emphasis added).

Thus, applying our "unstable endgroups" construction in a way that would include only the unstable endgroups that would be "expected" based on

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obvious by Kono. Pet. 40 ("Kono anticipates claims 1–5, and 7"); 50 ("Kono renders obvious claim 6").

the polymer's synthesis, Kono falls short of anticipating claims 1–7 of the '609 patent because it does not measure methyl ester endgroups. Ex. 1008, 12:57–60. On this point, Petitioner argues that "Dr. Iezzi opines that methyl esters are not detected when methanol is used as a chain transfer agent. (Ex. 1002 ¶ 57 (citing Ex. 1019, 1:53–57).)." Reply 16. We are not persuaded by this argument, however, because neither Dr. Iezzi's testimony nor the relied upon exhibit appear to speak in absolute terms regarding the formation of methyl ester groups when using methanol as a chain transfer agent. Dr. Iezzi states that the skilled artisan "would have understood that use of methanol as a chain transfer agent during polymerization *can result* in the formation of $–CF_2CH_2OH$ and $–COF$ endgroups in the fluoropolymer. Ex. 1019, 1:53–57." Ex. 1002 ¶ 57 (emphasis added). Because Dr. Iezzi does not expressly state $–CF_2CH_2OH$ and $–COF$ are the only endgroups that would result from using methanol as a chain transfer agent, however, we do not view his testimony as restricting the expected endgroups to only include $–CF_2CH_2OH$ and $–COF$. Significantly, the evidence upon which Dr. Iezzi relies also does not definitively address the presence or absence of methyl ester groups when using methanol as a chain transfer agent. *See* Ex. 1019, 1:53–57 ("If methanol is used as the chain transfer agent, $–CF_2H$ and $–CF_2CH_2OH$ end groups will also be present.").

Therefore, weighing the evidence before us on this point, one reference specifically mentions that methyl ester endgroups may form in "[t]he presence of methanol" when it is used as a "molecular weight modifier"—which is precisely how Kono appears to use methanol in Example 2 and Comparative Example 3. Ex. 1010, 5:35–39; Ex. 1008, 12:34–36, 13:7–10, 14:20–25. On the other hand, Dr. Iezzi lists endgroups that "can" form when methanol is used as a chain transfer agent, but does not definitively state such endgroups are the *only* ones that would be expected when using methanol in this manner. Ex. 1002 ¶ 57. Petitioner's evidence similarly mentions possible endgroups when methanol is used as a chain transfer agent, but does not foreclose the possibility of methyl ester endgroups forming. Ex. 1019, 1:53–55.

Thus, on balance, the record evidence that expressly discloses a connection between using methanol as a molecular weight modifier and the formation of methyl ester endgroups outweighs Petitioner's relied-upon evidence and Dr. Iezzi's silence on this key point. Ex. 1010, 5:35–39; Ex. 1002 ¶ 57; Ex. 1019, 1:53–55.

After considering the respective positions of Petitioner and Patent Owner,[10] and the record fully developed throughout this proceeding, we are not persuaded Petitioner has established by a preponderance of evidence that claims 1–7 of the '609 patent are anticipated by Kono's disclosure of Example 2 and Comparative Example 3. Specifically, Petitioner has not established that Kono's Example 2 and Comparative Example 3 "hav[e] no more than

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[10] Our anticipation analysis does not rely on Patent Owner's arguments regarding this ground as set forth in the Sur-Reply. Such arguments are objected to by Petitioner as being waived. Sur-Reply 14–17; Paper 48, 1–2; Paper 50, 4–7. Because we do not need to rely on Patent Owner's Sur-Reply arguments regarding this challenge, we need not address Petitioner's waiver argument.

about 50 unstable endgroups/10^6 carbon atoms" as required by each of the challenged claims. Ex. 1001, 10:21–22 (claim 1), 10:31–32 (dependent claim 6 requiring no more than about 20 unstable endgroups/10^6 carbon atoms).

In sum, because the evidence of record supports a conclusion that methyl ester endgroups would be expected to form when using methanol as a molecular weight modifier during FEP synthesis, and because Kono does not measure such methyl ester endgroups, Petitioner has not established by a preponderance of the evidence that Kono's Example 2 and Comparative Example 3 anticipate claims 1–7 of the '609 patent.

5. Asserted Obviousness Based on Kono (Grounds 3 and 4)

In the alternative, Petitioner asserts that claims 1–7 of the '609 patent are rendered obvious in view of Kono. Pet. 38–50 (Ground 3), 51 (Ground 4). In support of its obviousness challenge, Petitioner relies on the same general disclosure of Kono as in its anticipation challenge, and additionally relies on Kono's Comparative Example 5 as well as Kono's disclosure of a fluorination process. Pet. 51 (citing Ex. 1002 ¶¶ 198–202).

a. Stabilization via Fluorination Over Wet-Heat Treatment

Petitioner relies on purported benefits of fluorination to provide the motivation to stabilize the endgroups in Example 2 and Comparative Examples 3 and 5 via fluorination instead of other stabilization methods such as the wet-heat treatment used in Comparative Example 5. Pet. 51. Specifically, Petitioner argues that fluorination results in "better electrical properties obtained by converting –CF_2H endgroups to –CF_3 endgroups." *Id.* (citing Ex. 1002 ¶ 201; Ex. 1027, 3:35–38). Petitioner also notes that fluorination "was commonly used to remove unstable endgroups." *Id.*

On the fully developed record, Petitioner has not established by a preponderance of the evidence that it would have been obvious for the skilled artisan to employ fluorination instead of wet-heat treatment. Petitioner's assertion that fluorination "was commonly used," without more, is insufficient to establish the obviousness of the proffered substitution of stabilization methods. *See KSR*, 550 U.S. at 418 (explaining "there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness") (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)); *see also Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015) ("[O]bviousness concerns whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of prior art to arrive at the claimed invention.") (emphasis in original).

The articulated reasoning that Petitioner does provide to support the proffered substitution—i.e., the purported benefits of fluorination over wet-heat stabilization—falls short. Petitioner does not allege, much less provide evidence to persuasively establish, that any of Kono's Example 2 or Comparative Examples 3 and 5 individually have 50 or more terminal groups other than –CF_3, which appears to be the maximum number of such endgroups allowed to realize the purported beneficial electrical properties referred to by Petitioner. *See* Ex. 1027, 3:40–43 (explaining how "the polymer should have fewer than about 50 and preferably fewer than about 20 [end groups other than $–CF_3$] per million carbon atoms"). Kono does not measure endgroups in this manner, but rather focuses on three specific unstable endgroups. Ex. 1008, 12:57–59, 18:16–20. In the absence of such evidence, Petitioner has not established sufficiently that the skilled artisan would have had a reason to omit the wet-heat stabilization method employed in Kono's Comparative Example 5 and replace it with a fluorination process.

Furthermore, Petitioner has not established that the skilled artisan would have applied any stabilization process such as fluorination to Example 2 and Comparative Example 3, because Kono discloses that a certain limited number of unstable endgroups, i.e., "adhesion terminus" groups, are beneficial and desired. *See id.* at 5:1–33 (explaining how functional groups in the FEP "can be changed to contribute to increased adhesion with the core wire," and how the total number of –COF, –COOH, and $–CH_2OH$ groups may be between 15 and 150). Kono discloses that the "adhesive strength" between the polymer and the core wire should be "0.8 kg or more." *Id.* at 3:16–17, 4:48–51. Kono's Example 2 has 58 –COF, –COOH, and $–CH_2OH$ groups and exhibits an adhesion strength of 1.5 kg at an extrusion speed of 2800 ft/min and is described as being "superior." *Id.* at 15:50–57, Table 1. Comparative Example 3 has 50 such groups and exhibits a somewhat inferior adhesive strength of 1 kg at 2800 ft/min. *Id.* Here, we emphasize in particular how close the Comparative Example 3 FEP's adhesive strength is to the 0.8 kg minimum threshold taught by Kono. *Id.* at 3:16–17, 4:48–51. It is not clear on this record why the skilled artisan would have been motivated to potentially decrease the "superior" adhesion strength of the Example 2 FEP or the lower adhesive strength of the Comparative Example 3 FEP, by stabilizing the –COF, –COOH, and –CH_2OH groups that Kono teaches may "contribute to increased adhesion with the core wire." *Id.* at 5:1–33; *see also id.* at 2:10–15 (explaining how completely fluorinated FEP copolymers have inferior adhesion properties and suffer "severe shrink-back.").

b. Modification of Comparative Example 5's MFR

Petitioner acknowledges that Comparative Example 5 fails to meet the melt flow rate ("MFR") limitation recited in claim 1. Pet. 43 ("Under the proper BRI construction, however, 35.1 g/10 min is outside the literal scope of 'about 30±3 g/10 min'"). Petitioner asserts, however, that "the overlapping MFR range disclosed in Kono and the closeness of Comparative Example 5's MFR to claim 1's range supports a *prima facie* case of obviousness." *Id.* at 43–44. For support, Petitioner points to Kono's general disclosure of an MFR range of 30–45 g/10 min, and alleges the skilled artisan "would have been able to optimize the reagents and reaction conditions taught in Kono's Comparative Example 5" to meet the recited range through routine experimentation. *Id.* (citing Ex. 1002 ¶¶ 175–176).

We disagree that it would have been obvious to decrease Comparative Example 5's MFR of 35.1 g/10 min to fall within the scope of the recited range of "30±3 g/10 min." Comparative Example 5's MFR already falls within Kono's preferred and "more prefer[red]" MFR ranges of "30 (g/10 min.) or more" and "30 to 45 (g/10 min.)," respectively. Ex. 1008, 6:12–13, 6:26–27. Moreover, Kono disparages MFRs below 30 g/10 min, which is encompassed by the claimed range of "30 ± 3," because such MFR values may cause melt fracture to become severe, resulting in cone-breaks and spark-out. *Id.* at 6:21–25. Indeed, Comparative Example 5 has a higher MFR (35.1 g/10 min) than does Example 7 (34.5 g/10 min) and exhibited fewer "spark-outs" at all speeds measured vis-a-vis Example 7. *Id.* at 18:21–32. Thus, it is not clear on this record why the skilled artisan, based on the teachings of Kono, would have had a reason to decrease Comparative Example 5's MFR at all, much less to the recited range of 30±3 g/10 min.

Petitioner's reliance on Dr. Iezzi's opinion that it would have been obvious to decrease Comparative Example 5's MFR does not persuade us otherwise, because the evidence relied upon by Dr. Iezzi (Ex. 1032 ¶ 11) lacks sufficient specificity. Ex. 1002 ¶¶ 175–176. Namely, the relied-upon evidence generally refers to melt flow rates that are "too small" and "too large" without providing specific MFR values. *See* Ex. 1032 ¶ 11 (stating "[w]hen MFR is too small, the FEP copolymer has a high molecular weight so that some adjustment of the molding conditions such as increase of a melt temperature is necessary" and "[w]hen MFR is too large, the FEP copolymer has a low molecular weight so that decomposed materials of the copolymer may be formed."). The next paragraph in that evidence, however, provides relevant details on this point, stating "[f]rom these viewpoints, MFR (372°C, 5,000 g load) is from 10 to 35 g/min,[11] preferably from 15 to 30 g/10 min." *Id.* ¶ 12. Thus, the relied-upon evidence discloses that MFR values can be as high as 35 g/10 min, which is significantly close to Kono's Comparative Example 5's MFR of 35.1 g/10 min. *Id.*; Ex. 1008, 18:13. The evidence also appears to contradict Kono's teachings, in that the evidence prefers MFR values that Kono disparages. *Compare* Ex. 1032 ¶ 12 (preferring MFR values "from 15 to 30 g/10 min") *with* Ex. 1008, 6:21–25 ("If the MFR is less than 30 (g/10 min.), the extent of melt fracture becomes severe, cone-breaks or spark-out due to melt fracture may be observed in some cases, and it tends to be difficult to increase the coating speed."). Thus, we are not persuaded Petitioner has demonstrated sufficiently the skilled artisan would have been motivated to decrease the melt flow rate of Comparative Example 5 to be within the recited range of "30±3 g/10 min."

6. Asserted Obviousness Based on Kaulbach (Ground 5)

Petitioner asserts that claims 1–7 of the '609 patent are obvious in view of Kaulbach. Pet. 52–62 (citing Ex. 1002 ¶¶ 105–106, 203–240). Petitioner specifically relies on Sample A11 of Kaulbach and alleges that "[i]n Sample A11, Kaulbach discloses a copolymer that renders obvious each and every limitation of claims 1–7 of the '609 patent." *Id.* at 53. Petitioner sets forth a detailed explanation of how Kaulbach's Sample A11

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[11] This appears to be a typographical error in the MFR units as evidenced by other repeated recitations of "g/10 min" throughout the same evidence. Ex. 1032, code (57), ¶¶ 6, 12, 24, 48, 56, 59, 63, 67, 71.

purportedly meets or renders obvious the recited limitations. *Id.* at 53–62.

Specifically, Petitioner asserts that Kaulbach's Sample A11 is "[a] partially-crystalline copolymer" that "contains 87% by weight TFE and 13.0% by weight HFP" and "has an HFPI of 4.1." *Id.* at 53–54. Petitioner asserts that Kaulbach's copolymer is polymerized and isolated in the absence of added alkali metal salt, because Kaulbach's preferred polymerization recipe is "an alkali metal salt-free recipe" and is otherwise "silent regarding use or presence of alkali metal salt in obtaining Sample A11." *Id.* at 54.

Petitioner avers that although Sample A11 has a melt flow rate[12] of 24 g/10 min[13], it would have been obvious to modify Sample A11's melt flow rate to be within the claimed range of 30±3 g/10 min, because

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[12] Kaulbach refers to a "melt flow index" or "MFI" value. Ex. 1009, 1:40–41, 3:43–44. Patent Owner appears to acknowledge that "melt flow index" and "melt flow rate" may be used interchangeably. *See*, *e.g.*, PO Resp. 28 (stating how Kaulbach "discloses a target MFI (or melt flow rate)▯ of his polymer, and teaches the melt flow rate should remain unchanged"); *see also id.* at n.8 (assuming "that MFI and MFR are synonymous"). Thus, for purposes of this Final Decision, we treat the recited "melt flow rate" and Kaulbach's "melt flow index" as interchangeable phrases describing the same parameter.

[13] The parties agree that Kaulbach incorrectly reports melt flow rate in units of g/min rather than in g/10 min. Pet. 55 n.12; PO Resp. 28 n.7; *see also* Ex. 1002 ¶ 109 (Dr. Iezzi testifying that reading Kaulbach's units as g/min literally "is nonsensical, and would be recognized as such by a POSA"). Under these circumstances, and for purposes of this Final Decision, we treat Kaulbach's disclosure of melt flow rate in units of "g/min" as "g/10 min."

"Kaulbach teaches that the copolymers should have an MFR of 15 g/10 min or higher" and "does not provide an upper limit on the MFR range." Pet. 55. Thus, according to Petitioner, the claimed range "falls within Kaulbach's express range." *Id.* Petitioner asserts further that the skilled artisan "would have been motivated to modify Sample A11 to increase the MFR to meet Kaulbach's goal of providing 'a material . . . which can be processed at higher speeds'" because "[i]t was well known at the time of the '609 patent that the higher the MFR of the FEP-copolymer, the higher the speeds at which the copolymer can be processed." *Id.* at 56. Petitioner relies on Kono—asserted separately in this proceeding—as evidence that coating extrusion speed can be increased by increasing the polymer's MFR, and that MFR values below 30 g/10 min are not preferred because "melt fracture ('cone-breaks') can become severe, coating flaws may be observed, and increasing coating speed is difficult." *Id.* at 56 (citing Ex. 1008, 6:12–25). Finally, Petitioner points to Kaulbach's disclosure that Sample A11 has "28 endgroups" selected from $–COOH$, $–CONH_2$ and $–COF$ groups, and states "[g]iven Kaulbach's polymerization and processing techniques and the reagents employed therein, no other unstable endgroups would be present in the copolymer of Sample A11." *Id.* at 57, 57 n.13 (citing Ex. 1002 ¶ 220).

a. Melt Flow Rate

Patent Owner argues that Kaulbach does not disclose a melt flow rate above 24 g/10 min. PO Resp. 28–31. More particularly, Patent Owner argues (1) one of ordinary skill in the art would have understood Kaulbach's disclosure of an MFR of 15 g/10 min or higher is "nothing more than a rule of thumb in the industry;" (2) the breadth of Kaulbach's unbounded range renders the claimed MFR "of limited relevance;" and (3) Kaulbach's disclosure does not tell one of ordinary skill in the art anything about melt flow rates that would actually work in Kaulbach's invention. *Id.*

Kaulbach expressly discloses an example FEP having a melt flow rate of 24 g/10 min. Ex. 1009, 3:49–50. Importantly, Kaulbach also discloses that, to carry out "high speed wire extrusion the MFI of the polymer is ≥ 15."[14] *Id.* at 3:42–43, 8:59–60. Other evidence of record indicates FEP copolymers having MFR values of up to 50 g/10 min when "coating at a high speed," with values of 30–45 g/10 min being preferred, because such MFR values enable coating speeds of 2800 ft/min or more. Ex. 1008, 6:12–28, 5:51–55; *see also id.* at 6:21–25 ("If the MFR is less than 30 (g/10 min.), the extent of melt fracture becomes severe, cone-breaks or spark-out due to melt fracture may be observed in some cases, and it tends to be difficult to increase the coating speed."); Ex. 1006, 2:17–25 (describing fluoropolymers with MFR values from 15–50 g/10 min as "special" because they are "capable of high speed extrusion, but [] also exhibit[] excellent physical properties, characterized by high flex life"); *id.* at 3:13–17 (explaining that an extrusion speed of up to 3000 ft/min "is achieved by the fluoropolymer preferably

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[14] We note this disclosure of Kaulbach does not expressly recite the MFI, i.e., "MFR" units. Ex. 1009, 3:43–44. Because Patent Owner does not allege otherwise, but rather appears to concede Kaulbach's units are "g/10 min" (Sur-Reply 2), we treat Kaulbach's disclosure of "≥ 15" as a disclosure of "greater than or equal to 15 g/10 min" for purposes of this Final Written Decision.

having a melt flow rate of about 15 g/10 min to 50 g/10 min”).

The evidence of record establishes, and Patent Owner acknowledges (PO Resp. 24), that increasing MFR was a way to achieve higher coating speeds. Ex. 1002 ¶ 216 (Dr. Iezzi stating that “[i]t was well known and disclosed in the art as of the priority date of the ’609 patent that the higher the MFR (or the lower the viscosity) of an FEP-copolymer, the higher the speeds at which the copolymer can be processed”); Ex. 1008, 2:51–53 (“In order to increase the speed of the coating extrusion, it is generally preferred to reduce the melt viscosity of the resin”); Ex. 2006 ¶¶ 31–32 (Dr. Mecham explaining how MFR “is inversely related to melt viscosity and molecular weight,” that “the lower the melt viscosity and molecular weight of an FEP, the higher its MFR,” and “the higher the MFR, the faster the polymer could be coated onto a wire”); *see also* Ex. 1038, 88:20–22 (Dr. Mecham stating that “[t]here’s a general concept that if you have a higher MFR, you can process faster than if you have a lower MFR”). We also note Kaulbach’s express desire for “[h]igh processing speeds . . . when wires and cables are extrusion coated.” Ex. 1009, 1:29–30.

The evidence also establishes, however, that increasing MFR, i.e., lowering the melt viscosity, by too much may negatively impact coating quality by, e.g., decreasing the polymer’s resistance to stress cracking. Ex. 1008, 2:53–54; Ex. 1006, 1:32–40 (explaining how “melt viscosity of the polymer is a factor that limits the line speed” at which the wire is coated because, “[a]s line speed is increased, a point is reached at which the appearance and quality of the coating begin to deteriorate” and manifests as “surface roughness, variation in coating thicknesses, such as lumps of polymer at intervals along the wire, and defects in the insulating quality of the coating, known as 'sparks'").

Thus, the evidentiary record supports the general proposition that increasing the melt flow rate of a FEP copolymer may yield a desired increase in the speed at which a wire can be coated. The evidence also supports that melt flow rates of up to 50 g/10 min are suitable for such high speed wire coating applications for speeds up to 3000 ft/min.

Turning back to Kaulbach's Sample A11 copolymer, we note it exhibited no "noticeable die drools and no cone-breaks" when coating a wire at line speeds of 1710 and 2006 feet per minute. Ex. 1009, 9:1–22. In another wire coating test, it "did not show noticeable die drool and exhibited only 2 cone-breaks during a period of 29 hours of extruding" various wire colors at a speed of 1700 ft/min. *Id.* at 9:34–47, 10:7–9. In view of Kaulbach's disclosure that MFR values of ≥ 15g/10 min are suitable for high speed wire extrusion, and record evidence establishing that higher coating speeds of 2800 or 3000 ft/min are possible, we are persuaded that the skilled artisan would have been motivated to improve upon the wire coating speeds observed with Kaulbach's Sample A11. We also are persuaded that the skilled artisan would have been motivated to increase the MFR of Kaulbach's Sample A11 to be within the recited range in order to achieve higher processing speeds, because the evidence of record teaches that achieving such speeds may be possible by increasing a FEP copolymer's MFR.

We disagree that Kaulbach discloses an "unbounded" range of MFR values in its disclosure of ≥ 15 g/10 min, thus encompassing "an infinite number of polymers, with melt flow rates of 50, 100, 1000, 10,000 and even higher," because assessing the true scope of a prior art reference requires viewing it through the eyes of the person of ordinary skill. PO Resp. 29 (citing Ex. 2006 ¶ 58); *see In re Rouffet*, 149 F.3d 1350, 1357 (Fed. Cir. 1998) ("Obviousness is determined from the vantage point of a hypothetical person having ordinary skill in the art to which the patent pertains.").

Record evidence on this point does not support that the skilled artisan would have viewed Kaulbach's MFR disclosure of ≥ 15 g/10 min in the manner argued by Patent Owner. PO Resp. 28–31. Rather, the evidence suggests the skilled artisan would have viewed Kaulbach's disclosure as imposing a practical maximum limit on a polymer's melt flow rate. *See* Ex. 1008, 2:51–54 ("In order to increase the speed of the coating extrusion, it is generally preferred to reduce the melt viscosity of the resin. On the other hand, *resistance to stress cracking of the resin decreases because of the lowered melt viscosity*" (emphasis added)); Ex. 1006, 3:21–27 (explaining how manufacturing "high melt flow rate fluoropolymers is not only a matter of reducing molecular weight," because the polymer's physical properties "are strongly dependent upon molecular weight," and, by extension, melt flow rate). In other words, the prior art teaches that the melt flow rate cannot be increased too much, because doing so would negatively impact the physical properties of the coating, such as its resistance to stress cracking.

Moreover, it appears from the evidence that the skilled artisan would have understood there is a "practical maximum" to the melt flow rate parameter, because at some point it becomes too high to effectively coat a wire. Ex. 2006 ¶ 58 (Dr. Mecham stating the skilled artisan "would understand that there is a practical maximum to the MFR of Kaulbach's polymer" because "[a]t some MFR, Kaulbach's FEP would have too low of a melt viscosity, such that it could not be processed at any speed, much less at high speeds"); Ex. 1038, 136:6–11 (Dr. Mecham testifying that "Kaulbach's open-ended MFR range would include all kinds of polymers that had MFRs higher than what he discloses as 24, and anyone who is skilled in the art would understand that there's a maximum to that"); PO Resp. 29.

We are persuaded that the skilled artisan would have been motivated to increase the melt flow rate (MFR) of Kaulbach's Sample A11 FEP from 24 g/10 min[15] to be within the recited range of "about 30±3 g/10 min" in order to achieve higher wire-coating speeds, as asserted in the Petition. Pet. 55–56. The evidence of record establishes the skilled artisan would not have understood Kaulbach's MFR range of ≥15 g/10 min to be "unbounded," but rather would have viewed such disclosure to be a "closed" MFR range, with 15 g/10 min being the minimum value, and the "practical

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[15] Dr. Iezzi addresses an apparent typographical error in Kaulbach's MFR units, stating "an MFR value of 24 g/min would convert to a value of 240 g/10 min, which is nonsensical, and which would be recognized as such by a POSA." Ex. 1002 ¶ 109.

maximum" value depending on the fluoropolymer's overall composition and processing parameters.[16]

b. Molecular Weight Distribution

Patent Owner also argues that that the skilled artisan would not have been motivated to increase Sample A11's melt flow rate to be within the claimed range, because doing so would broaden its molecular weight distribution ("MWD") against Kaulbach's teachings. PO Resp. 3, 23–27, 29, 31–34; Sur-Reply 2, 3, 9–14. Patent Owner argues, particularly, that Kaulbach's invention is a FEP with a "very narrow molecular-weight distribution." PO Resp. 26–27 (citing Ex. 1009, 3:34–35, 3:59–65). Thus, Patent Owner argues, Kaulbach teaches against common practices that were known to broaden the molecular weight distribution of a polymer, such as using chain transfer agents during polymerization, and against using high fluorination temperatures. *Id.* at 27.

In our review of the evidence, Kaulbach is vague regarding how "narrow molecular weight distribution" is defined. Although Kaulbach discloses "a *very narrow* molecular-weight distribution, i.e., a ratio of Mw to Mn of less than about 2 (Mw=weight average, Mn=number average molecular weight)" which "may

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[16] Dr. Mecham testifies that the maximum MFR value in a given process which "yield[s] an adequate coating" depends on a number of parameters such as the polymer's monomer composition and molecular weight distribution, and the processing conditions such as temperature and pressure. Ex. 1038, 83:7–84:10. Dr. Iezzi testifies that while Kaulbach does not disclose the maximum MFR, "[t]here would be some upper limit . . . that could be 100, could be 150, could be high, well above" the 24 g/10 min provided for Sample A11. Ex. 2010, 77:7–20.

be as low as 1.5," Kaulbach does not then precisely define what is considered "narrow" or "broad" distributions along the molecular weight distribution spectrum. Ex. 1009, 3:35—38 (emphasis added). The measured MWD value for Sample A11 was 1.6, which seemingly falls within Kaulbach's "very narrow" MWD range of 1.5 to less than about 2. *Id.* at 8:62–63. Because Kaulbach does not specifically set forth numerical limits on the Mw/Mn ratios that constitute "narrow" and "broad" molecular weight distributions, it is plausible that the skilled artisan may have been able to slightly increase Sample A11's MFR of 24 g/10 min to be within the claimed range, and still end up with a "narrow" MWD polymer as suggested by Kaulbach, even if that meant slightly "broadening" Sample A11's MWD.

In any event, the skilled artisan would not have been constrained to follow only Kaulbach's teachings regarding a "narrow" molecular weight distribution from the entire universe of available prior art when considering how to increase the coating speed of Kaulbach's Sample A11. Rather, the person of ordinary skill would have considered *all* the available knowledge at his or her disposal regarding how to accomplish a higher coating speed, including increasing Sample A11's MFR. Record evidence supports the proposition that broad molecular weight distribution polymers have certain benefits, such as high strength. *See* Ex. 1038, 92:19–93:2 (Dr. Mecham testifying "if you have a broader molecular-weight distribution, you have a higher composition of – or a higher fraction of high-molecular weight materials, that's going to strengthen the material more than if you had a narrow distribution where you didn't have that high fraction"); *id.* at 171:5–12 (Dr. Mecham testifying that increasing MFR without broadening the molecular weight is problematic and may lead to a polymer with poor strength and poor processing conditions); *see also* PO Resp. 25 ("Broadening the molecular weight distribution of an FEP allows one to create a polymer with enough low molecular weight chains to keep the melt viscosity low, but also enough high molecular weight chains to *boost the mechanical properties, stability, and insulation quality of the final coating*." (citing Ex. 2013, 2:60–3:2; Ex. 2012, 44, 63) (emphasis added)).

Furthermore, Patent Owner admits that maintaining a narrow molecular weight distribution in the copolymer magnifies "[t]he drawbacks and challenges of increasing melt flow rate" because "the polymer chains have a narrower range of length and molecular weight." PO Resp. 32. Thus, according to Patent Owner, "to increase Kaulbach's melt flow rate to within the claimed range *but retain its narrow distribution*, one would have to decrease the molecular weight of all of the polymer chains," which "would magnify the problems of high melt flow rate products (e.g., decreased mechanical and physical properties) and likely result in an unusable coating." *Id.* at 32–33 (emphasis added); *see also* Ex. 1038, 136:13–15 (Dr. Mecham testifying that increasing Kaulbach's MFR "any higher than [] 24 [g/10 min] is risky *with that narrow molecular weight distribution*" (emphasis added)). Due to the potential problems associated with keeping the molecular weight distribution narrow, then, it is not clear on this fully developed record why the skilled artisan would have been motivated to maintain such a narrow molecular weight distribution when seeking to achieve even higher coating speeds with Kaulbach's Sample A11.

On this point, Kaulbach states that "a narrow molecular weight distribution performs better" at achieving high processing rates than polymers with "broad" molecular weight distributions. Ex. 1009, 3:59–65. This portion of Kaulbach's disclosure, however, lacks specificity regarding what is deemed "narrow" and "broad." Furthermore, this general statement does not seem to apply to the specific Sample A11 copolymer which achieved processing speeds of 1710, 2006, and 1700 feet per minute (Ex. 1009, 9:1–47 (Tables 3 and 4)), speeds that are significantly lower than those achieved by Kono's process, which Patent Owner and Dr. Mecham admit uses a "broad" molecular weight distribution. PO Resp. 33; Ex. 2006 ¶ 165. Thus, even though Kaulbach generically touts that "high processing rates can be achieved" "[d]espite a narrow molecular weight distribution" (Ex. 1009, 3:59–60), this purported discovery would not have prevented the skilled artisan, at the time of the invention of the '609 patent, from considering other techniques—such as broadening the polymer's molecular weight distribution—to achieve higher coating speeds with Sample A11. Based on the evidence presented, we are persuaded that one such technique would have included increasing Sample A11's MFR from 24 g/10 min to the recited range of "about 30±3 g/10 min," even if doing so would have required broadening the molecular weight distribution of the polymer beyond the "narrow molecular weight distribution" suggested, but not required or precisely defined, by Kaulbach.

The preponderance of the evidence supports Petitioner's assertion that Kaulbach's Sample A11 polymer meets all of the limitations of claims 1–7, except for the express melt flow rate limitation of "about 30±3 g/10 min." Ex. 1002 ¶¶ 203–240; Ex. 1009, 7:8–48, 8:57–9:47. For the reasons expressed above, however, Petitioner has persuaded us that the skilled artisan would have been motivated to increase the melt flow rate of Kaulbach's Sample A11 from 24 g/10 min to be within the range of "about 30±3 g/10 min" as recited in claims 1–7 in order to achieve higher wire coating speeds than those observed for Sample A11. In sum, we are persuaded by Petitioner's arguments, evidence, and claim chart supporting its challenge that Kaulbach renders claims 1–7 of the '609 patent obvious. Pet. 52–62.

7. *Objective Indicia of Non-Obviousness*

Before we make a final obviousness determination, we must consider the evidence of obviousness in light of any evidence of secondary considerations of nonobviousness presented by Patent Owner. *See Graham*, 383 U.S. at 17–18 ("Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. As indicia of obviousness or nonobviousness, these inquiries may have relevancy."); *Transocean Offshore Deepwater Drilling, Inc. v. Maersk Drilling USA, Inc.*, 699 F.3d 1340, 1349 (Fed. Cir. 2012) ("This objective evidence must be 'considered as part of all the evidence, not just when the decisionmaker remains in doubt after reviewing the art.'" (quoting *Stratoflex,* *Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1538–39 (Fed. Cir. 1983))).

All types of objective evidence of nonobviousness must be shown to have a nexus to the claimed invention. *In re GPAC Inc.*, 57 F.3d 1573, 1580 (Fed. Cir. 1995) (nexus generally); *In re Huang*, 100 F.3d 135, 140 (Fed. Cir. 1996) (commercial success). The stronger the showing of nexus, the greater the weight accorded the objective evidence of nonobviousness. *See Ashland Oil, Inc. v. Delta Resins & Refractories*, Inc., 776 F.2d 281, 306 (Fed. Cir. 1985), *cert. denied*, 475 U.S. 1017 (1986).

Patent Owner presents arguments directed to objective indicia of non-obviousness. PO Resp. 36–40. These objective indicia include an allegation regarding the claimed subject matter's unexpected results, its commercial success, long-felt but unmet need, and industry praise. *Id.*

a. Unexpected Results

To be particularly probative, evidence of unexpected results must establish that there is a difference between the results obtained and those of the closest prior art, and that the difference would not have been expected by one of ordinary skill in the art at the time of the invention. *Kao Corp. v. Unilever U.S., Inc.*, 441 F.3d 963, 970 (Fed. Cir. 2006). Patent Owner alleges that the combination of alkali metal salt concentration, melt flow rate, and number of unstable endgroups recited in claims 1–7 "unexpectedly results in a superior wire coating" that is "capable of high speed extrusion at lower extrusion temperatures, produces high quality coating over a broad polymer melt temperature range, and enjoys long extrusion runs without the need to shut down the extruder for cleaning." PO Resp. 36–37 (citing Ex. 1001, 1:60–67, 3:50–56). Patent Owner asserts the recited alkali metal salts and maximum stable endgroups prevent "degradation at severe operating conditions." *Id.* at 37 (citing Ex. 1001, 7:10–20, 6:44–51). Patent Owner also avers "the claimed FEP unexpectedly exhibits superior electrical properties as compared to prior art FEPs." *Id.* (citing Ex. 1001, 8:27–64).

We find no persuasive merit in Patent Owner's assertion of unexpected superior results. "[W]hen unexpected results are used as evidence of non-obviousness, the results must be shown to be unexpected compared with the closest prior art." *In re Baxter Travenol Labs.*, 952 F.2d 388, 392 (Fed. Cir. 1991). "It is well settled that unexpected results must be established by factual evidence. Mere argument or *conclusory statements in the specification does not suffice*." *In re De Blauwe*, 736 F.2d 699, 705 (Fed. Cir. 1984) (emphasis added). Patent Owner relies merely on general statements within the patent itself, rather than any data that compares the claimed invention to the closest prior art. Patent Owner's general statement that "the claimed FEP unexpectedly exhibits superior electrical properties as compared to prior art FEPs" fails to quantify the superior electrical properties of the claimed FEP, fails to identify the prior art FEPs or delineate their electrical properties, and fails to compare the two to provide the factual evidence required by case law.

b. Commercial Success

"When a patentee can demonstrate commercial success, usually shown by significant sales in a relevant market, and that the successful product is the invention disclosed and claimed in the patent, it is presumed that the commercial success is due to the patented invention." *J.T. Eaton & Co. v. Atl. Paste & Glue Co.*, 106 F.3d 1563, 1571 (Fed. Cir. 1997); *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1329 (Fed. Cir. 2016). "Demonstrating that an invention has commercial value, that it is commercially successful, weighs in favor of its non-obviousness." *WBIP*, 829 F.3d at 1337.

Patent Owner alleges that the FEP 9494 polymer, which Patent Owner asserts is encompassed by claims 1–7, is a commercial success because "FEP 9494 sales grew substantially after its introduction to the industry in 2005, and the revenue from sales of FEP 9494 since that time demonstrates the commercial success of the product." PO Resp. 37 (citing Ex. 2007 ¶¶ 10, 30–34). Patent Owner states that "gross profit margins from FEP 9494 demonstrate that FEP 9494 is highly profitable, which is further indicative of its commercial success." *Id.* at 37–38 (citing Ex. 2007 ¶¶ 12, 35–37). Patent Owner also asserts that FEP 9494 "exceeded expectations in the marketplace and outperformed other fluoropolymer products," further evincing commercial success. *Id.* at 38 (citing Ex. 2007 ¶¶ 13, 38–41).

We begin with the required nexus inquiry. *See Ashland Oil*, 776 F.2d at 305 n.42 ("Case law requires that a nexus be established between the merits of the claimed invention and the evidence proffered on secondary considerations, if the evidence on secondary considerations is to be given substantial weight in the calculus of obviousness/nonobviousness."). The presumption of nexus between the proffered evidence and the merits of the claimed invention (*see J.T. Eaton*, 106 F.3d at 1571) is rebuttable, as "a patent challenger may respond by presenting evidence that shows the proffered objective evidence was 'due to extraneous factors other than the patented invention.'" *WBIP*, 829 F.3d at 1329 (quoting *Demaco Corp. v. F. Von Langsdorff Licensing Ltd.*, 851 F.2d 1387, 1393 (Fed. Cir. 1988)). Such evidence may include, for example, demonstrating the commercial success "is due to an unclaimed feature," or if such feature "was known in the prior art." *Ormco Corp. v. Align Tech., Inc.*, 463 F.3d 1299, 1312 (Fed. Cir. 2006); *see also Richdel, Inc. v. Sunspool Corp.*, 714 F.2d 1573, 1580 (Fed. Cir. 1983) (holding the claims obvious despite a purported showing of commercial success when the patentee failed to show the "commercial success [] its marketed system enjoyed was due to anything disclosed in the patent in suit which was not readily available in the prior art").

Here, we determine that insufficient nexus exists between FEP 9494 and the limitations of challenged claims 1–7, because the claimed features were already disclosed in the prior art. Specifically, as set forth *supra* in our discussion regarding Kaulbach, Sample A11 satisfies all of the recited elements except for the melt flow rate limitation of "about 30±3 g/10 min." Ex. 1009, 8:57–65. Kaulbach discloses melt flow rates of greater than or equal to 15 g/10 min being used for high speed wire extrusion, which encompasses the claimed range. Ex. 1009, 3:42–43. Other evidence of record discloses FEP copolymers having MFR values of up to 50 g/10 min when "coating at a high speed," with values of 30–45 g/10 min being preferred because such MFR values enable coating speeds of 2800 ft/min or more. Ex. 1008, 6:12–28, 5:51–55; *see also id.* at 6:21–25 ("If the MFR is less than 30 (g/10 min), the extent of melt fracture becomes severe, cone-breaks or spark-out due to melt fracture may be observed in some cases, and it tends to be difficult to increase the coating speed."); Ex. 1006, 2:17–25 (describing fluoropolymers with MFR values from 15–50 g/10 min as "special" because they are "capable of high speed extrusion, but [] also exhibit[] excellent physical properties, characterized by high flex life"); *id.* at 3:13–17 (explaining that an extrusion speed of up to 3000 ft/min "is achieved by the fluoropolymer preferably having a melt flow rate of about 15 g/10 min to 50 g/10 min"). In view of such express disclosure in the prior art, the claimed features were indeed known. Under such circumstances, we find an insufficient nexus between the proffered evidence and the merits of the claimed invention.

Moreover, even assuming there is sufficient nexus, we still find Patent Owner's evidence insufficient to establish commercial success. Specifically, Patent Owner does not provide sufficient evidence regarding FEP 9494's market share. First, Patent Owner does not make clear what it believes the relevant market to be, nor the size or volume of the relevant market. Instead, Patent Owner presents gross sales figures for FEP 9494, but such gross sales figures, particularly in the absence of a defined market, are inadequate to establish commercial success. *See Ex parte Jellá*, 90 USPQ 1009, 1012 (BPAI 2008) (precedential) ("[G]ross sales figures do not show commercial success absent evidence as to market share . . . or as to the time period during which the product was sold, or as to what sales would normally be expected in the market").

Even further, a proper commercial success analysis requires according the appropriate weight to any such evidence. When, as here, the patent itself may have precluded others from entering the relevant market, sales figures are weak evidence of commercial success. *See Merck & Co., Inc. v. Teva Pharm. USA, Inc.*, 395 F.3d 1364, 1376–77 (Fed. Cir. 2005) (explaining how financial success of a given product "is not significantly probative" of non-obviousness when "others were legally barred from commercially testing" them, and how "[b]ecause market entry by others was precluded on" the bases of patent protection and FDA exclusivity, "the inference of non-obviousness . . . from evidence of commercial success, is weak").

Patent Owner relies in part on various sales figures from 2005 through 2018 for FEP 9494. Ex. 2007 ¶¶ 10, 30–34. Patent Owner states that FEP 9494 is covered by the claims of the '609 patent, which issued on October 17, 2006, from an application filed on June 21, 2004, and claiming priority to a provisional filed on May 14, 2003. PO Resp. 37; Ex. 1001, codes (22), (45), (60). Thus, the existence of the '609 patent, covering the FEP 9494 product, would have precluded others from freely entering the market. *See Galderma Labs., L.P. v. Tolmar, Inc.*, 737 F.3d 731, 740 (Fed. Cir. 2013) (quoting *Merck & Co.*, 395 F.3d at 1377) ("Where 'market entry by others was precluded [due to blocking patents], the inference of non-obviousness of [the asserted claims], from evidence of commercial success, is weak.'"). Because FEP 9494 was covered by at least one patent from 2006–2011, and by at least two patents (US Patents 7,122,609 B2 and 8,076,431 B2) from 2011–2018, Patent Owner's proffered sales data is weak, and the alleged commercial success of FEP 9494 is mitigated by the existence of blocking patents, because those patents would have precluded others from entering the relevant market.

In sum, after considering the fully developed record evidence, we are not persuaded that Patent Owner's arguments and evidence regarding the FEP 9494 polymer's commercial success outweigh the obviousness of claims 1–7 of the '609 patent.

c. Long-felt Need

As discussed above, we find an insufficient nexus between the proffered evidence and the merits of the claimed invention. Accordingly, even if Patent Owner presented persuasive evidence of long-felt need, the required nexus would still be lacking. Nevertheless, we discuss Patent Owner's evidence relating to long-felt need.

Evidence of a long felt but unsolved need that is met by the claimed invention is further evidence of non-obviousness. *Millennium Pharm., Inc. v. Sandoz Inc.*, 862 F.3d 1356, 1369 (Fed. Cir. 2017). Establishing long-felt need first requires objective evidence that a recognized problem existed in the art for a long period without solution. *See Orthopedic Equip. Co., Inc. v. All Orthopedic Appliances, Inc.*, 707 F.2d 1376 (Fed. Cir. 1983); *In re Gershon*, 372 F.2d 535, 539 (CCPA 1967). Second, another must not have satisfied the long-felt need before the invention of the challenged patent. *Newell Cos. v. Kenney Mfg. Co.*, 864 F.2d 757, 768 (Fed. Cir. 1988). Third, the invention of the challenged patent must satisfy the long-felt need. *In re Cavanagh*, 436 F.2d 491, 496 (CCPA 1971); *see also*

Perfect Web Techs., Inc. v. InfoUSA, Inc., 587 F.3d 1324, 1332–33 (Fed. Cir. 2009) (articulating all three factors).

Patent Owner asserts the FEP 9494 "filled a long-felt need in the industry and received tremendous industry praise," because it "significantly reduced plate out, could be extruded at high speeds with fewer faults, and processed consistently from start to finish of the extrusion process and from lot to lot." PO Resp. 38 (citing Ex. 2008 ¶¶ 3, 4, 7, 10, 11).

We cannot determine, from Patent Owner's presentation of the evidence, whether the recognized problem existed in the art for a long period without solution. Patent Owner makes general statements about the problems of the then-existing FEPs on the market. PO Resp. 38. These statements, however, do not persuasively establish the length of time the recognized problem existed. Patent Owner's evidence also does not establish the exact nature of the "recognized problem" solved by FEP 9494. Although the competitor's products referred to by Patent Owner allegedly had problems that "often resulted in unusable wire," it appears from the logical converse that those products would have sometimes resulted in usable wire. *Id.* Accordingly, although Patent Owner's FEP 9494 may have been a better product, it is not clear that it solved a recognized problem that existed without solution.

In a similar vein, because Patent Owner admits "a number of FEPs for use in plenum-rated cables were on the market at the time," (PO Resp. 38) it is unclear that Patent Owner establishes that "another must not have satisfied the long-felt need before the invention of the challenged patent." *Newell*, 864 F.2d at 768. Patent Owner asserts that FEP 9494 possessed properties superior to those of the existing products on the market, but this assertion does not answer the question of whether the long-felt need was not satisfied by the existing products. Again, Patent Owner's evidence does not establish that the existing FEPs could not be extruded at high speeds while still producing a high quality wire coating.

d. Industry Praise

As discussed above, we find an insufficient nexus between the proffered evidence and the merits of the claimed invention. Accordingly, even if Patent Owner presented persuasive evidence of industry praise, the required nexus would still be lacking. Nevertheless, we discuss Patent Owner's evidence relating to industry praise.

Industry praise for an invention may provide evidence of non-obviousness where the industry praise is linked to the claimed invention. *See Geo. M. Martin Co. v. Alliance Mach. Sys. Int'l LLC*, 618 F.3d 1294, 1305 (Fed. Cir. 2010); *Asyst Techs. Inc. v. Emtrak, Inc.*, 544 F.3d 1310, 1316 (Fed. Cir. 2008).

Patent Owner points to one customer's enthusiasm for FEP 9494 and that customer's 18-month exclusivity agreement, assertedly because FEP 9494 was perceived by that customer to be "the best product on the market because of its superior processing and coating properties." PO Resp. 39 (citing Ex. 2008 ¶ 111). Petitioner disagrees with Patent Owner's characterization of the customer enthusiasm for the FEP 9494 product. *See generally* Reply 25–26.

On this record, Patent Owner's evidence of industry praise is entitled to minimal weight. Although there is some evidence describing the enthusiasm of one customer for FEP 9494, this sole customer's enthusiasm is not shown to be reflective of the industry's opinion as a whole, and thus, we agree with Petitioner that much of Patent Owner's evidence is of little probative value.

III. MOTION TO EXCLUDE

Petitioner moves to exclude (1) Exhibit 2040 (a Chemours brochure) as untimely non-testimonial evidence; (2) Section IV(c) of Patent Owner's Sur-Reply as waived because the arguments therein were omitted from the Response; and (3) Section III of Patent Owner's Sur-Reply as waived because the arguments therein were not addressed in the Response. Paper 48, 1–5. Patent Owner filed a Response. Paper 49. Petitioner filed a Reply. Paper 51.

Regarding the exhibit and portions of the Sur-Reply sought to be excluded, we do not affirmatively rely upon Exhibit 2040 in our present determination, nor do we need to rely on the identified Patent Owner arguments in Section IV(c) or Section III of its Sur-Reply. Therefore, we need not decide Patent Owner's Motion to Exclude, and we dismiss the motion and request as moot.

We note that Petitioner styles its motion as a "Motion to Exclude and Strike." Paper 48, 1. Petitioner notes: "To preserve their objections and arguments, Petitioners hereby move to strike and exclude the improper evidence and argument." *Id.* at 1 n.1. We have addressed the portion of Petitioner's combined motion directed to excluding evidence and portions of papers before us, and have determined to dismiss Petitioner's motion as moot. Accordingly, we need not reach the portion of Petitioner's combined motion directed to striking the same, even if such a portion of the motion were properly presented.

Accordingly, the Motion to Exclude is *dismissed*.

IV. MOTIONS TO SEAL

Patent Owner and Petitioner each filed three separate Motions to Seal portions of certain papers and exhibits. Papers 16, 38, 43 (Patent Owner); Papers 24, 36, 54 (Petitioner).

In its first Motion to Seal, Patent Owner seeks to seal the confidential versions of Exhibits 2007, 2009, 2021, 2022, 2029–2032, 2034, and 2036, namely, the Declarations of John Hansen and Gregory Chapman, and documents containing financial and other proprietary information relied upon by Patent Owner in making its secondary considerations case. Paper 16, 1–4. Patent Owner represents that the parties agreed to a modified version of the Board's Default Protective Order, and submits a Proposed Protective Order as Appendix A. *Id.* at 5. In its second Motion to Seal, Patent Owner seeks to seal its Patent Owner Response to Petitioner's Motion for Routine and Additional Discovery (Paper 30). Paper 38, 1. Patent Owner submitted both a public and a confidential version of this document. Papers 30, 39. In its third Motion to Seal, Patent Owner seeks to seal Exhibit 2039. Paper 43, 1. Patent Owner represents that good cause exists because this document references Exhibits 2036 and 1040, also sought to be placed under seal. *Id.* at 2.

In its first Motion to Seal, Petitioner seeks to seal Petitioners' Motion for Routine and Additional Discovery from Patent Owner (Paper 25). Paper 24, 1. Petitioner submits that good cause exists to seal this paper to the extent it references or incorporates information from Exhibits 2021, 2029, and 2032. *Id.* at 1–2. In its second Motion to Seal, Petitioner seeks to seal Petitioner's Reply (Paper 35), and Exhibits 1040, 1041, and 1043. Paper 36, 1. Petitioner represents that the Reply and other exhibits sought to be sealed reference information that Patent Owner has designated as confidential. *Id.* at 2. Petitioner submitted both a public and a confidential version of its Reply. Papers 34, 35. In its third Motion to Seal, Petitioner seeks to seal Petitioner's demonstrative exhibits, filed as Exhibit 1062. Paper 54. Regarding Petitioner's third Motion to Seal, the Board, pursuant to a call with the parties, expunged the version of the demonstrative exhibits containing confidential information, and required Petitioner to file a version of the demonstrative exhibits that contained no confidential information. Ex. 1063, 21:20–24, 26:14–17. Petitioner filed such a version of its demonstrative exhibits (also designated Exhibit 1062) and, thus, Petitioner's third Motion to Seal is dismissed as moot.

"There is a strong public policy for making all information filed in a quasi-judicial administrative proceeding open to the public, especially in an *inter partes* review which determines the patentability of claims in an issued patent and therefore affects the rights of the public." *Garmin Int'l v. Cuozzo Speed Techs., LLC*, IPR2012-00001, Paper 34 at 1–2 (PTAB Mar. 14, 2013). For this reason, except as otherwise ordered, the record of an *inter partes* review trial shall be made available to the public. *See* 35 U.S.C. § 316(a)(1); 37 C.F.R. § 42.14. The standard for granting a motion to seal is good cause. 37 C.F.R. § 42.54. That standard includes showing that the information addressed in the motion to seal is truly confidential, and that such confidentiality outweighs the strong public interest in having the record open to the public. *See Garmin*, Paper 34 at 2–3.

After having considered the arguments, we determine that the parties establish good cause for sealing the documents identified in the respective Motions. Specifically, the parties demonstrate that the information they seek to seal consists of exhibits and testimony dealing with confidential financial information and proprietary information regarding products germane to this proceeding, and papers that rely on the exhibits and testimony sought to be sealed. *See, e.g.,* Paper 16, 2–4; Paper 24, 1–2; Paper 36, 1–4; Paper 38, 2; Paper 43, 2. Accordingly, the Motions (Papers 16, 24, 36, 38, and 43) are *granted* and the Proposed Protective Order (Paper 16, Appendix A) is *entered*. As discussed above, however, Petitioner's third Motion to Seal (Paper 54) is *dismissed* as moot.

There is an expectation that information will be made public where the information is identified in a final written decision, and that confidential information that is subject to a protective order ordinarily would become public 45 days after final judgment in a trial, unless a motion to expunge is granted. 37 C.F.R. § 42.56; Office Patent Trial Practice Guide, 77 Fed. Reg. 48,756, 48,761 (Aug. 14, 2012). A party who is dissatisfied with the Final Decision may appeal the Decision pursuant to 35 U.S.C. § 141(c), and has 63 days after the date of the

Decision to file a notice of appeal. 37 C.F.R. § 90.3(a). Thus, it remains necessary to maintain the record, as is, until resolution of an appeal, if any. In view of the foregoing, the confidential documents filed in the instant proceeding will remain under seal, at least until the time period for filing a notice of appeal has expired or, if an appeal is taken, the appeal process has concluded. The record for the instant proceeding will be preserved in its entirety, and the confidential documents will not be expunged or made public, pending appeal. Notwithstanding 37 C.F.R. § 42.56 and the Office Patent Trial Practice Guide, neither a motion to expunge confidential documents nor a motion to maintain these documents under seal is necessary or authorized at this time. *See* 37 C.F.R. § 42.5(b).

V. CONCLUSION[17]

We conclude that Petitioner has satisfied its burden of demonstrating, by a preponderance of the evidence, that the subject matter of claims 1–7 of the ’609 patent are unpatentable.

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[17] Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner’s attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. *See* 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

VI. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner establishes, by a preponderance of the evidence, that claims 1–7 of U.S. Patent No. 7,122,609 B2 are unpatentable;

FURTHER ORDERED that Petitioner's Motion to Exclude is *dismissed*;

FURTHER ORDERED that the parties' Motions to Seal (Papers 16, 24, 36, 38, and 43) are *granted* and the Proposed Protective Order (Paper 16, Appendix A) *entered*, but that Petitioner's third Motion to Seal (Paper 54) is *dismissed* as moot; and

FURTHER ORDERED that this is a Final Written Decision; therefore, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

In summary:

Claims	**35 U.S.C. §**	**Reference(s)/ Basis**	**Claims Shown Unpatent -able**	**Claims Not Shown Unpatent -able**
1–7	102(a)	Hiraga		1–7
1–7	103(a)	Hiraga, Kaulbach		1–7
1–7	102(e)(2)	Kono		1–7
1–7	103(a)	Kono		1–7
1–7	103(a)	Kaulbach	1–7	
Overall Out-come			1–7	

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APPENDIX D

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Paper No. 63
Entered: November 12, 2019

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DAIKIN INDUSTRIES LTD. and DAIKIN AMERICA, INC.,
Petitioner,

v.

THE CHEMOURS COMPANY FC, LLC,
Patent Owner.

IPR2018-00993
Patent 8,076,431 B2

Before JO-ANNE M. KOKOSKI, KRISTINA M. KALAN, and SHELDON M. MCGEE, *Administrative Patent Judges.*

MCGEE, *Administrative Patent Judge.*

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

Dismissing Patent Owner's Motion to Exclude
37 C.F.R. § 42.64(c)

Granting/Dismissing Petitioner's and Patent Owner's Motions to Seal
37 C.F.R. § 42.54

I. INTRODUCTION

Daikin Industries, Ltd. and Daikin America, Inc. (collectively, "Petitioner") filed a Petition requesting an *inter partes* review of claims 1–7 of U.S. Patent No. 8,076,431 (Ex. 1001, "the '431 patent"). Paper 1 ("Pet."). The Chemours Company FC, LLC ("Patent Owner") filed a Preliminary Response to the Petition. Paper 7 ("Prelim. Resp."). Along with its Preliminary Response, Patent Owner filed a Statutory Disclaimer of claims 1, 2, and 5–7 of the '431 patent. Prelim. Resp. 1; Ex. 2005.[1]

We instituted an *inter partes* review of remaining claims 3 and 4 of the '431 patent on all grounds of unpatentability alleged in the Petition. Paper 12 ("Institution Decision" or "Dec."). After institution of trial, Patent Owner filed a Patent Owner Response. Paper 19 ("PO Resp."). Petitioner filed a Reply. Papers 39, 40 ("Reply"). Patent Owner filed a Sur-Reply to Petitioner's Reply. Paper 46 ("Sur-Reply").

An oral hearing was held on August 7, 2019. A transcript of the hearing is included in the record. Paper 62. ("Tr.").

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a). For the reasons that follow, we determine that Petitioner has established by a preponderance of

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[1] Patent Owner's Statutory Disclaimer of claims 1, 2, and 5–7 has rendered Petitioner's anticipation challenge based on Hiraga moot. Dec. 10, n.4.

the evidence that claims 3 and 4 of the ’431 patent are unpatentable.

A. Related Proceedings

The parties identify the following district court proceeding as related to the ’431 patent: *Chemours Company FC, LLC v. Daikin Industries, Ltd.*, U.S. District Court for the District of Delaware, Civil Action No. 1:17-cv-01612-GMS. Pet. 60; Paper 4, 2.

B. The ’431 Patent

The ’431 patent, titled “High Melt Flow Fluoropolymer,” issued on December 13, 2011. Ex. 1001, at code (54), (45). The ’431 patent relates to partially-crystalline fluoropolymers that are copolymers of tetrafluoroethylene (“TFE”) and hexafluoropropylene (“HFP”). *Id.* at 2:7–10. Such copolymers, also known as fluorinated ethylene-propylene or “FEP” copolymers, “can be extruded at high speed onto conductor over a broad polymer melt temperature range to give insulated wire of high quality.” *Id.* at 1:59–61; 7:53–55; Ex. 1002 ¶ 124.

According to the ’431 patent, during “conductor coating operation, the presence of alkali metal salt in the fluoropolymer promotes the formation of fluoropolymer drool on the outer surface of the extrusion” equipment, which “appear[s] as unacceptable lumps of insulation” on the wire. Ex. 1001, 3:7–16. Thus, the fluoropolymer of the ’431 patent “is free of, i.e., does not contain, alkali metal salt in the sense that no alkali metal salt is used in the polymerization or in the isolation of the resulting fluoropolymer.” *Id.* at 3:16–20.

The ’431 patent also informs that its polymers may contain thermally or hydrolytically unstable endgroups, e.g., $–CF_2CH_2OH$, $–CONH_2$, –COF, and –COOH, which react “usually by decomposition, at temperatures at which fluoropolymers are melt-processed.” *Id.* at 3:31–39. The ’431 patent thus teaches that a fluorination process is carried out to convert such “unstable endgroups to the stable $–CF_3$ endgroup.” *Id.* at 3:31–34.

C Challenged Claims

Claims 3 and 4 of the ’431 patent each depend from and include the limitations of now-disclaimed independent claim 1. Disclaimed claim 1, and remaining claims 3 and 4, are reproduced below:

> 1. A partially-crystalline copolymer comprising tetrafluoroethylene [TFE], hexafluoropropylene [HFP] in an amount corresponding to hexafluoropropylene index (HFPI) of from about 2.8 to 5.3, said copolymer having less than about 50 ppm alkali metal ion, having a melt flow rate of within the range of about 30±3 g/10 min as determined by ASTM D1238 at 372° C., and having no more than about 50 unstable endgroups/10^6 carbon atoms.
>
> 3. The polymer of claim 1 wherein said copolymer has less than about 10 ppm alkali metal ion.
>
> 4. The polymer of claim 1 wherein said copolymer has less than about 5 ppm alkali metal ion.

Ex. 1001, 6, 10:9–22.

D. Instituted Grounds of Unpatentability

We instituted an *inter partes* review of claims 3 and 4 of the '431 patent on the following grounds. Dec. 8, 30.

Ground(s)[2]	**Claims Challenged**	**35 U.S.C. §**	**Reference(s) / Basis**
2	3, 4	103(a)	Hiraga,[3] Kaulbach[4]
3	3, 4	103(a)	Hiraga
4, 5	3, 4	102(e)(2), 103(a)	Kono[5]
6	3, 4	103(a)	Kaulbach

Petitioner relies on the Declarations of Dr. Robert Iezzi (Ex. 1002) and Daniel M. McGavock (Ex. 1040). Patent Owner relies on the Declarations of Dr. Sue Mecham (Ex. 2006), John L. Hansen (Ex. 2007), Randall Crenshaw (Ex. 2008), and Gregory A. Chapman (Ex. 2009).

II. ANALYSIS

A. Claim Construction

For petitions filed prior to November 13, 2018, the Board interprets claims in an unexpired patent using

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[2] Petitioner's anticipation challenge of claims 1, 2, and 5–7 based on Hiraga was rendered moot in view of Patent Owner's disclaimer of all claims included in this challenge. Ex. 2005; Dec. 10, n.4.

[3] Ex. 1025, Hiraga et al., JP 2002-249585, published September 6, 2002 (as translated).

[4] Ex. 1009, Kaulbach et al., US 6,541,588 B1, issued April 1, 2003.

[5] Ex. 1008, US 6,743,508 B2, issued June 1, 2004.

the "broadest reasonable construction in light of the specification of the patent." 37 C.F.R. § 42.100(b) (2017); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016). Under that standard, claim terms are given their ordinary and customary meaning in view of the specification, as would be understood by one of ordinary skill in the art at the time of the invention. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Any special definitions for claim terms must be set forth in the specification with reasonable clarity, deliberateness, and precision. *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). Only those terms that are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) ("we need only construe terms 'that are in controversy, and only to the extent necessary to resolve the controversy'") (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

Petitioner proffered claim constructions for the terms "about 30±3 g/10 min," and "about 50 unstable endgroups." Pet. 16–20. Specifically, Petitioner asserted the term "about 30±3 g/10 min" should be construed as "greater than 26 g/10 min and less than 34 g/10 min." *Id.* at 17. Petitioner also stated that "because the challenged claims are not method claims and do not recite any particular polymerization process," the broadest reasonable construction of the term "unstable endgroups" should "include unstable endgroups resulting from any FEP polymerization process." *Id.* at 20.

In its Preliminary Response, Patent Owner averred that an express construction was not necessary for either of the terms "about 30±3 g/10 min" or "about 50 unstable endgroups." Prelim. Resp. 8–9. Patent Owner did, however, accept and apply Petitioner's proffered "construction of 'unstable endgroups' as including not only the four exemplary endgroups listed in the '431 patent, but all stable endgroups resulting from any FEP process." Prelim. Resp. 9.

In our Institution Decision, we considered the evidence and the parties' mutually proffered constructions to construe the term "unstable endgroups" to include "[all] unstable endgroups resulting from any FEP polymerization process." Dec. 11. Based on that construction, we determined that Petitioner's challenges based on the Kono reference were deficient, because, *inter alia*, Kono does not measure "[all] unstable endgroups" per our construction of this term, such as ethyl groups or methyl ester groups. Dec. 23–24, 26.

Petitioner, in its Reply, addressed the "unstable endgroups" construction as it was applied to the anticipation and obviousness challenges based on Kono, expressing concern that our construction included "all" endgroups, regardless of the actual synthesis conditions employed in the relied-upon Examples and Comparative Examples. Reply 1, 10; Pet. 33–50; Dec. 22–24, 26. Petitioner argued that the skilled artisan would not "speculate about ***unused*** synthesis conditions, and neither should the Board." Reply 1. Specifically, Petitioner argued that statements made by Patent Owner in the Preliminary Response "led the Board astray" because Patent Owner insisted Kono must measure "all unstable endgroups regardless of Kono's actual synthesis conditions." *Id.* at 10; *see also* Tr. 13:18–19 ("We never used the word 'all,' it was brought in through Chemours' arguments in the POPR."). According to Petitioner, Patent Owner "criticized Kono for not quantifying all known endgroups, *e.g.*, methyl (alkyl) ester and ethyl," but as both parties' experts agree, "no alkyl ester endgroups would be formed because Kono uses no alcohol in Example 5C." *Id.* at 10–11. Petitioner further argues that Patent Owner's declarant, Dr. Mecham, "accounts for only four unstable endgroups" in her analysis of a product relied on by Patent Owner to demonstrate commercial success and "ignores others because they would not be expected to result in the product based on its synthesis." *Id.* at 11. Petitioner contends Dr. Mecham "concedes that unstable endgroups do not spontaneously appear." *Id.* Petitioner also avers the '431 patent does not support "an all-endgroups requirement" because, for example, it "omits ethyl groups." *Id.* at 11–12. Thus, according to Petitioner, it is "unreasonable to construe 'unstable endgroups' to require accounting of all known endgroups, even ones unexpected based on the synthesis used." *Id.* at 12.

During the oral hearing, Petitioner repeated its disagreement with the claim construction adopted in the Institution Decision as it was applied to certain challenges. Tr. 6:19–17:19. Petitioner agreed, however, that the claim construction set forth in the Institution Decision is correct as long as the references are not "criticized for not identifying end groups that would be unexpected or impossible to form." *Id.* at 14:8–14; *see also id.* at 16:20–17:8 (Petitioner asserting "all we want to make sure is it's clear that the claim construction only requires the prior art to show end groups that possibly -- that would be possible or expected by a person of skill in the art.”).

Given that claim terms are interpreted in view of the knowledge of one of ordinary skill in the art at the time of the invention, we see no reason to modify our earlier construction. On the record now before us, and using the applicable standard of broadest reasonable interpretation, we maintain our construction of “unstable endgroups” to include “[all] unstable endgroups resulting from any FEP polymerization process.” Dec. 10–11.

On the complete record, we determine that it is not necessary to provide an express construction for any other claim term for purposes of resolving the controversy. *See, e.g., Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011) (“[C]laim terms need only be construed ‘to the extent necessary to resolve the controversy.’”) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

B. Level of Ordinary Skill in the Art

Petitioner’s declarant, Dr. Iezzi, asserts that one of ordinary skill in the art

> would have a bachelor’s degree or the equivalent training or experience in engineering, chemistry, materials science, or a related field and at least three years of experience relating to research and development of melt-processable fluoropolymers, including extrusion thereof, or a master’s degree or the equivalent training or experience in engineering, chemistry, materials science, or a related field and at least one years of experience

> relating to research and development of melt-processable fluoropolymers, including extrusion thereof.

Ex. 1002 ¶ 25.

Patent Owner does not appear to dispute Petitioner's definition of one of ordinary skill in the art. *See generally* PO Resp. Neither party argues that the outcome of this case would differ based on our adoption of any particular definition of one of ordinary skill in the art. In light of the record now before us, we adopt Petitioner's definition of one of ordinary skill in the art. The level of ordinary skill in the art is also reflected by the references themselves. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) ("[T]he absence of specific findings on the level of skill in the art does not give rise to reversible error 'where the prior art itself reflects an appropriate level and a need for testimony is not shown.'"); *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (finding that the Board of Patent Appeals and Interferences did not err in concluding that the level of ordinary skill in the art was best determined by the references of record).

C. Overview of the Asserted References

1. Hiraga

Hiraga discloses methods of modifying a fluoropolymer via a melt-kneading process. Ex. 1025, 1 at code (57). Hiraga discloses that the modification method efficiently stabilizes unstable groups contained on the melt-processable fluoropolymer, homogenizes and prevents a decrease in the fluoropolymer's molecular weight, and increases the fluoropolymer's processability, thus enabling the production of “a molded article free of air bubbles and coloration.” *Id.* ¶ 11.

Hiraga’s method “may be applied to any melt-processable fluorine-containing polymer having unstable groups, but is particularly effective as a stabilization treatment for the unstable groups of’ copolymers containing “tetrafluoroethylene (TFE) [and] hexafluoropropylene (HFP),” such as “FEP” polymers. *Id.* ¶¶ 19, 26. According to Hiraga, unstable groups include vinyl end groups ($–CF=CF_2$) and acid fluoride end groups (–COF), and may cause bubbles and cavities to form in the final product. *Id.* ¶ 3. To achieve “the most homogeneous molecular weight possible, and not simply stabilize the unstable groups,” Hiraga teaches that it is important “that water is not present” during the first step, i.e., “step (A),” “in which the treatment with oxygen-containing gas is carried out.” *Id.* ¶ 30. Because the fluoropolymer’s unstable groups cannot be stabilized in the presence of oxygen alone, however, the fluoropolymer “is melt-kneaded in the presence of oxygen while further aggressively introducing water, thereby both stabilizing the unstable groups and also oxidizing to remove coloration substances (step (B)).” *Id.* ¶ 41. Hiraga discloses that a reaction accelerator may be added before or during either step A or step B, and that such reaction accelerators may be a compound containing an alkaline metal, an alkaline earth metal, an ammonium salt, ammonia, an alcohol, an amine, or a salt thereof. *Id.* ¶¶ 48–49.

Hiraga discloses Example 1 and Comparative Example 1, where in Comparative Example 1, a modified FEP polymer of Example 1 containing 15 ppm potassium was processed to yield a FEP copolymer with a melt flow rate of 30.0 g/10 min, and zero unstable groups per 10^6 carbons. *Id.* ¶¶ 107, 114–117.

2. Kaulbach

Kaulbach discloses "melt-processable tetrafluoroethylene (TFE)/hexafluoropropylene (HFP) copolymer melt pellets having an improved processability for wire and cable application and to a method of using this polymer to coat wire and cable conductors." Ex. 1009, 1:9–13.

Kaulbach teaches that "metal contaminants may result in degradation and decomposition of the copolymer at high processing temperatures," which may in turn cause discoloration, degradation, and "a build up of die drools." *Id.* at 2:4–8. According to Kaulbach, "[d]ie drools are accumulations of molecular fractions of the polymer at the surface of the die exit" and "impair the coating processing." *Id.* at 2:8–10.

To assist with this and other potential problems, Kaulbach instructs that the copolymer "should be made more thermally stable not only by eliminating the thermally unstable endgroups but also by avoiding metal contaminants." *Id.* at 2:27–29. Kaulbach states that the polymer "material is essentially of high purity grade as to metals; that is the total amount of iron, chromium, [and] nickel is less than 200 parts per billion (ppb), preferably less than 100 ppb." *Id.* at 3:24–32. Kaulbach states that "[i]t is believed that metal contaminants, in particular heavy metals like Fe, Ni, [and] Cr might induce a decomposition reaction," and by using material that contains less than 50 ppb of Fe, Ni, and Cr ions, "the material according to the invention can be called a high purity grade." *Id.* at 4:18–20.

Kaulbach discloses that the manufacturing process for preparing the polymer includes polymerization, coagulation, agglomeration, fluorination, and pelletizing. *Id.* at 4:25–6:30.

Kaulbach discloses that "[t]he polymerization may be carried out in form of a radical emulsion polymerization as it is known in the art," and that initiators such as ammonium or potassium persulfate may be used, along with emulsifiers such as "the ammonium salt of perfluoro-octanoic acid" and buffers such as "NH_3, $(NH_4)_2CO_3$ or $NaHCO_3$" in the polymerization recipe. *Id.* at 4:27–34. Kaulbach discloses that a "preferred version of the polymerization recipe here is an alkali metal salt-free recipe." *Id.* at 4:44–45.

Regarding coagulation, Kaulbach states that mechanical coagulation is preferred over chemical coagulation because chemical coagulation "is generally done with acids" which is "not preferred as it results in very high levels of metal contaminants at all subsequent work up steps." *Id.* at 5:3–17.

Kaulbach seeks to minimize introducing metal contamination during fluorination by ensuring the "agglomerate is soft enough to not scratch off metal contaminants from the wall of the tumble drier." *Id.* at 5:46–48. Kaulbach also instructs that "[m]elt-pelletizing fluorinated agglomerates provides many advantages compared to the melt pelletizing of non fluorinated agglomerates"—one of which is substantially reducing equipment corrosion that results in an insignificant "pick up of metal contamination." *Id.* at 6:1–8.

Kaulbach states that "[h]igh processing speeds are desired when wires and cables are extrusion coated" and that "[t]o increase the extrusion speed the molecular weight distribution of the used copolymer is believed to be very broad" for FEP copolymers. *Id.* at 1:29–36. Kaulbach notes that "according to conventional wisdom," FEP mixtures that "have a very broad molecular weight distribution which . . . results in [] improved extrudability." *Id.* at 1:56–59. Kaulbach's inventive polymers purport to have "a very narrow molecular-weight distribution, i.e., a ratio of Mw to Mn of less than about 2 (Mw=weight average, Mn=number average molecular weight)," which "may be as low as 1.5," and "is in contrast to FEP-grades recommended for wire coatings with high extrudation rates where a broad molecular weight distribution is recommended." *Id.* at 3:34–41. Kaulbach states that "the art teaches that a broad molecular weight distribution is needed to achieve such high processing rates," but that "[i]t has now been discovered that a narrow molecular weight distribution performs better, thus overcoming a well established prejudice." *Id.* at 3:61–65.

Kaulbach discloses that, "[f]or high speed wire extrusion[,] the MFI [melt flow index] of the polymer is $\geq$ 15." *Id.* at 3:42–43. Kaulbach discloses several example copolymers. One is "[a] melt pelletized copolymer with a MFI-value of 24 [g/10 min] and containing 15% HFP" which "can be extruded with a wire coating extruder at . . . a rate of 1500 feet/min over a run time of the equipment of 6 hours without exhibiting discoloration and without producing substantial amounts of die drools and with fewer cone-breaks in contrast to commercial FEP grades." *Id.* at 3:49–56. Another example copolymer (Sample A11) exhibited a MFI value of 24 g/10 min and had a measured molecular weight distribution value of 1.6. *Id.* at 8:57–65.

3. Kono

Kono discloses pellets that comprise "a copolymer obtained by copolymerizing monomer components containing tetrafluoroethylene (TFE) and hexafluoropropylene (HFP)," also known as a "FEP pellet." Ex. 1008, 3:32–36. Kono discloses that the inventive FEP pellet is used in a coating extrusion process for insulating a core wire, i.e., by melting the FEP pellet "by heating within an extruder for coating a core wire and extrude[ing] from a die, and then draw[ing] down by coating the core wire to thereby form an insulated cable." *Id.* at 4:29–34.

Kono discloses that the extrusion process with the inventive FEP pellet can be carried out at a speed of 2800 ft/min when the adhesive strength between the insulating material and the core wire is 0.8 kg or more. *Id.* at 4:42–50. Kono hypothesizes that the "excellent adhesive strength" exhibited by the inventive FEP pellets when extruded may be due to the presence of a certain functional group, also known as an "adhesion factor" or, if the adhesion factor is located at the end of the polymer, as an "adhesion terminus." *Id.* at 5:1–9. Kono teaches that the adhesion terminus is "not particularly limited as long as it contributes to enhanced adhesion with the core wire at high temperature, and includes, for example, a functional group which is generally known to be unstable at high temperature." *Id.* at 5:14–18. Kono identifies several such known functional groups, including $–COOM$, $–SO_3M$, $–OSO_3M$, $–SO_2F$, $–SO_2Cl$, $–COF$, $–CH_2OH$, $–CONH_2$, and $–CF{=}CF_2$, where M is selected from an alkyl group, a hydrogen atom, a metallic cation and a quaternary ammonium cation. *Id.* at 5:18–22. Kono discloses that the number of functional groups located at the terminal portion of the polymer depends on a number of factors, including the polymer's melt flow rate and the monomers present therein. *Id.* at 5:23–27.

Kono discloses example pelletized FEP powders where, *inter alia*, the number of certain functional groups (i.e., "adhesion terminus" groups) per 10^6 carbon atoms were measured. *Id.* at 12:11–16:47. The "adhesion terminus" groups measured for Kono's Examples 1–7 and Kono's Comparative Examples 1–5 were limited to $–COF$, $–COOH$, and $–CH_2OH$. *Id.* at 15:1–18:20.

D. Analysis

To anticipate a claim under 35 U.S.C. § 102, "a single prior art reference must expressly or inherently disclose each claim limitation." *Finisar Corp. v. DirecTV Grp., Inc.*, 523 F.3d 1323, 1334 (Fed. Cir. 2008). Accordingly, "'the dispositive question regarding anticipation [i]s whether one skilled in the art would reasonably understand or infer from the [prior art reference's] teaching' that every claim element was disclosed in that single reference." *Dayco Prods., Inc. v. Total Containment, Inc.*, 329 F.3d 1358, 1368 (Fed. Cir. 2003) (quoting *In re Baxter Travenol Labs.*, 952 F.2d 388, 390 (Fed. Cir. 1991)).

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious to a person of ordinary skill in the art at the time the invention was made. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). Obviousness is resolved based on underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness, i.e., secondary considerations. *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). Factual inquiries for an obviousness determination include secondary considerations based on evaluation and crediting of objective evidence of nonobviousness. *Graham*, 383 U.S. at 17. Secondary considerations may include any of the following: long-felt but unmet needs, failure of others, unexpected results, commercial success, copying, licensing, and praise. *Id.* The totality of the evidence submitted may show that the challenged claims would not have been obvious to one of ordinary skill in the art. *In re Piasecki*, 745 F.2d 1468, 1471–72 (Fed. Cir. 1984).

Petitioner bears the burden of proving unpatentability of the challenged claims, and the burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). Petitioner must demonstrate unpatentability by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d); *see also Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C.

§ 312(a)(3) (requiring *inter partes* review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim")). A party that petitions the Board for a determination of obviousness must show that "a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success in doing so." *Procter & Gamble Co. v. Teva Pharm. USA, Inc.*, 566 F.3d 989, 994 (Fed. Cir. 2009) (quoting *Pfizer, Inc. v. Apotex, Inc.*, 408 F.3d 1348, 1361 (Fed. Cir. 2007)).

1. Asserted Obviousness Based on Hiraga and Kaulbach

Petitioner asserts that claims 3 and 4 are unpatentable under 35 U.S.C. § 103(a) as obvious over the combined disclosures of Hiraga and Kaulbach. Pet. 30–31; Exs. 1025, 1009. Specifically, Petitioner provides a detailed explanation alleging where each limitation of claims 3 and 4—as well as now-disclaimed claim 1 from which these claims depend—can be found in Hiraga and Kaulbach. Pet. 21–27, 30–31 (citing Ex. 1002 ¶¶ 80–82, 95–128, and 130–134). Patent Owner does not challenge Petitioner's mapping, but rather focuses on Petitioner's proffered motivation to modify Hiraga's copolymers to arrive at the recited alkali metal concentration. PO Response 12–22.

The obviousness challenge presented by Petitioner relies on Kaulbach's teachings to provide the requisite motivation to "avoid using alkali metal in Hiraga's Comparative Example 1" FEP because "Kaulbach touts the benefits of an alkali-metal free process by emphasizing that the absence of metal contamination in melt-processable FEP-copolymers can prevent degradation and decomposition." Pet. 30. Petitioner avers that the skilled artisan would have been motivated to instead employ a different, non-alkali metal reaction accelerator during the stabilization step. Pet. 30–31 (citing Ex. 1025 ¶¶ 11, 48, 109); *see also* Ex. 1025 ¶¶ 45, 107, 114.

Petitioner's position, in sum, is that Kaulbach's disclosure would have motivated the skilled artisan to avoid stabilizing Hiraga's Comparative Example 1 FEP copolymer with an alkali metal salt, thus yielding an alkali metal ion concentration of less than 10 ppm (per claim 3) or 5 ppm (per claim 4). Pet. 30–31.

We disagree. Kaulbach does not treat all types of metals as "contaminants" as alleged by Petitioner. *Id.* at 7, 30; Reply 3. Rather, despite the commonality of the word "metal," Kaulbach distinguishes between heavy metal "contaminants" on one hand, and alkali metal salts—which may be purposefully added during FEP synthesis—on the other. Ex. 1009, 4:18–20, 45–46. Based on these distinctions made by Kaulbach, we are not persuaded that alkali metal salts would have been understood by the skilled artisan—consulting Kaulbach alone as set forth in the Petition—to be a "contaminant" that should be avoided.

Petitioner does not point us to any instance where Kaulbach refers to an alkali metal salt as a "contaminant." Pet., *generally*; Reply, *generally*. Rather, in specifically addressing the source of "metal contamination," we note that Kaulbach discusses corrosion of the FEP-polymer processing equipment, which undisputedly is not made of alkali metals. *See*

Ex. 2006 ¶ 46 (Dr. Mecham explaining that "processing equipment typically used in FEP synthesis and extrusion is made of corrosion-resistant metal alloys that typically contain high levels of nickel," a heavy metal, and not alkali metals due to "their high reactivity and physical characteristics"); Ex. 2010 at 50:17–19 (Dr. Iezzi agreeing that processing equipment is not made of alkali metals). Kaulbach states "[m]elt pelletizing of unstabilized polymer resins results in corrosion of the equipment used in the process and in metal contamination of the melt pellets," and notes that a stabilization process that uses water steam "is very difficult to manage due to corrosion of the equipment." Ex. 1009, 1:65–2:3.

Kaulbach also notes that "excessive metal contamination should be avoided" during fluorination of the agglomerate. *Id.* at 2:39–40. Kaulbach explains that "[t]he fluorination is carried out in a tumble drier to keep the material in motion," and that the "agglomerate is soft enough to not scratch off metal contaminants from the wall of the tumble drier. Thus the level of metal contaminants is reduced." *Id.* at 5:35–36, 5:46–48; *see also id.* at 5:53–58 (explaining that during the fluorination, "hard and sharp melt pellets scratch off a considerable amount of metal from the wall of the tumble drier" and how "[i]ncreasing reaction times result in higher metal contamination" which "is difficult to remove" and how "[t]he level of metal contamination was observed to increase by up to 2 orders of magnitude[] when the pellet process was used."). Also, in discussing the advantages of melt pelletizing fluorinated agglomerates over non-fluorinated agglomerates, Kaulbach notes one such advantage is that "[t]he corrosion of the equipment is substantially reduced. The pick up of metal contamination thus is insignificant." *Id.* at 6:1–8. Furthermore, in discussing an "aqueous treatment" step post-fluorination, Kaulbach notes that "the near-absence of gaseous decomposition chemicals and acidic endgroups reduce the corrosion of the stainless steel water treatment vessel considerably. Thus further heavy metal contamination is diminished." *Id.* at 6:23–27; *see also id.* at 5:14–17 (expressing a preference for non-acidic methods during the coagulation step because using acids "results in very high levels of metal contaminants at all subsequent work up steps."); Ex. 2010, 56:9–13 (Dr. Iezzi explaining that "[c]hemical coagulation is generally . . . not done with acids" and that Kaulbach "says [it is] generally not done with acids, and he does say [it is] not preferred because you could get high levels of metal contamination."); Ex. 2006 ¶ 49 (Dr. Mecham explaining that Kaulbach teaches to avoid acids during polymer coagulation "because acids can corrode the processing equipment, thereby leading to heavy metal contaminants in the polymer.").

Kaulbach also specifically identifies a class of metals—"heavy metals"—as "metal contaminants," and then identifies iron, nickel, and chromium as three such heavy metals. Ex. 1009, 4:18–20; *see also id.* at 7:55–65 (identifying Fe, Ni, and Cr as "metal contaminations" for samples A0 and A1). The equipment used to process FEP polymers is "typically made of corrosion-resistant metal alloys with a high nickel content." Ex. 2006 ¶ 25 (citing Ex. 2019, 3–4). When referring to "the polymer of the invention" as "essentially of high purity grade as to metals," Kaulbach states that this means "the total amount of iron, chromium, [and] nickel is less than 200 parts per billion (ppb), preferably less than 100 ppb." *Id.* at 3:24–32.

Alkali metal salts are undisputedly not heavy metals, and have a different purpose in Kaulbach than the heavy metals that Kaulbach seeks to avoid. Ex. 2010, 51:21–22; Ex. 2006 ¶ 46. Notably, Kaulbach discloses that an alkali metal salt, such as sodium bicarbonate buffer, can be intentionally added during FEP polymerization. Ex. 1009, 4:33–34. Dr. Iezzi, acknowledges that intentionally added components would not be considered a "contaminant." Ex. 2010, 52:9-17.[6]

Kaulbach discloses a preference for an alkali metal salt-free polymerization recipe. Ex. 1009, 4:45–46. Quite significantly, however, Kaulbach does not indicate why such recipe is preferred. *Id., generally.* Furthermore, Dr. Iezzi acknowledges there are more steps to FEP synthesis than the "polymerization" step, such as isolation (or "coagulation")[7], and stabilization. Ex. 2010, 42:2–43:17. Kaulbach is silent about

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[6] We observe that Dr. Iezzi's testimony on this point conflicts with Petitioner's counsel's representation of that testimony during the oral hearing. *Compare* Tr. 30:11–20 ("if you intentionally add a metal, it's a contaminant to the polymer, because it causes problems when you go to use it to coat it onto wires," and "that's our expert's interpretation of Kaulbach") *with* Ex. 2010, 52:9–17 ("Q. As we've discussed, there might be reasons to add alkali metal salts to a polymer reaction. . . . There might be reasons to add alkali metal salts, right? A. Yes. Q. That wouldn't be a contamination if you purposely added it though, right? A. That is correct.").

[7] *See* Ex. 2006 ¶ 23 (Dr. Mecham explaining "[c]oagulation . . . is one method of isolating a polymer").

avoiding or minimizing alkali metals during such FEP-synthesis steps post-polymerization. Ex. 1009, *generally*. The evidence of record establishes that alkali metal salts were known to be intentionally added—sometimes preferably—during the isolation and stabilization of fluorine-containing polymers such as FEP copolymers of tetrafluoroethylene (TFE) and hexafluoropropylene (HFP). Ex. 1025 ¶¶ 2, 3, 12, 17, 48, 49; Ex. 1026, 4:6–18; Ex. 2011, 6:1–5; *see also* Ex. 2006 ¶ 49 (Dr. Mecham testifying that "alkali metal salts were commonly used during chemical coagulation in the early 2000s"). Thus, Kaulbach's lack of direction to avoid alkali metal salts during the coagulation and stabilization steps of its FEP polymer supports Patent Owner's position that Kaulbach does not teach avoiding alkali metal salts altogether. It further supports Patent Owner's position that alkali metal salts, unlike heavy metals, are not considered "contaminants" by Kaulbach. PO Resp. 2, 14–18.

In view of this distinction made by Kaulbach between heavy metals as contaminants and purposefully added alkali metal salts, we are not persuaded by Petitioner's proffered rationale—inaccurately leveraging Kaulbach's use of the common term "metal"—for modifying Hiraga's Comparative Example 1 FEP to exclude alkali metal salt. *See* Pet. 30 ("Kaulbach touts the *benefits of an alkali-metal free process* by emphasizing that the *absence of metal contamination* in melt-processable FEP copolymers can prevent degradation and decomposition," thus the skilled artisan "would have been motivated to *avoid using alkali metal* in Hiraga's Comparative Example 1" (emphasis added)). Kaulbach's disclosure of a "preferred" alkali metal salt-free polymerization recipe, without more, is not enough to persuade us otherwise because Kaulbach does not explain precisely why the alkali metal salt free polymerization recipe is the preferred one, nor does it specify that alkali metal salts must be absent from every step of the polymerization process. Thus, Petitioner has not established that Kaulbach's disclosure would have motivated the skilled artisan to reduce or eliminate the presence of alkali metals during all steps of synthesizing Hiraga's Comparative Example 1 FEP for the reasons proffered. Pet. 30.

In sum, we are not persuaded that Petitioner has established by a preponderance of the evidence that claims 3 and 4 of the '431 patent are unpatentable over Hiraga and Kaulbach.

2. Asserted Obviousness Based on Hiraga

Petitioner asserts that Hiraga renders claims 3 and 4 of the '431 patent[8] obvious under 35 U.S.C. § 103(a). Pet. 32–33. Petitioner asserts the skilled artisan would have found it obvious to substitute Hiraga's melt-kneading process of Comparative Example 1, which employs an alkali metal, with a fluorination process that does not. *Id.* at 32 (citing Ex. 1002 ¶¶ 137–140). Petitioner alternatively asserts it would have been obvious "to use melt-kneading only to adjust the [melt flow rate] of the copolymer and separately remove unstable endgroups using fluorination." *Id.*

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[8] Although Petitioner challenges claims 1–7 (Pet. 32–33), we need only consider claims 3 and 4 in view of the statutory disclaimer of claims 1, 2, and 5–7. Ex. 2005; Dec. 17, n.6.[9]

See Ex. 1025 ¶ 4 (explaining that unstable end groups can be "treated in the presence of water and heat and thus are converted to stable $-CF_2H$ groups").

Petitioner first asserts the skilled artisan would have replaced both of Hiraga's melt-kneading steps (A) and (B) with fluorination. *Id.* at 32. We note Petitioner's acknowledgment that Hiraga's "[s]tep (A) narrows the FEP's molecular weight distribution by melt-kneading in the presence of heat and oxygen to homogenize molecular weight," while "[s]tep (B) then stabilizes the FEP by melt-kneading with heat, oxygen, and water." Reply 8–9. Indeed, Hiraga is not only concerned with stabilizing unstable endgroups of a fluoropolymer, but also seeks to tailor the polymer's molecular weight. *See* Ex. 1025 ¶ 30 ("The object of the present invention is to adjust the molecular weight and create a polymer with the most homogeneous molecular weight possible, and not simply stabilize the unstable groups.").

Petitioner, however, has not shown that substituting both melt-kneading steps (A) and (B) with a fluorination step alone would have had any impact on a fluoropolymer's molecular weight, and consequently, its Melt Flow Rate ("MFR"). Pet. 32–33; Reply 8–10. Petitioner acknowledges, and provides record evidence establishing, that a fluoropolymer's molecular weight is inversely related to its MFR. Pet. 9 ("MFR is inversely related to melt viscosity and also molecular weight." (citing Ex. 1002 ¶ 50; Ex. 1009, 6:33–35; Ex. 1006, 3:21–27)); Dec. 19.

Thus, on this record, it remains unclear what impact—if any—a fluorination process alone would have on the MFR of Hiraga's Comparative Example 1 polymer. Pet. 32–33. Hiraga's Comparative Example 1 has a MFR prior to melt kneading of 25 g/10 min, which is outside of the range of "about 30±3 g/10 min" recited in claims 3 and 4. Ex. 1025¶¶ 107, 114, 117.

Without evidence that fluorination alone would impact the MFR, we are unpersuaded that applying fluorination without any melt-kneading to Hiraga's Comparative Example 1 would result in a fluoropolymer with a melt flow rate of "about 30±3 g/10 min." Thus, Petitioner's first proffered basis for modifying Hiraga—replacing both melt-kneading steps (A) and (B) with fluorination alone (Pet. 32)—lacks persuasive merit.

Second, Petitioner contends that the skilled artisan would have found it obvious to first melt-knead Hiraga's Comparative Example 1 polymer in step (A), then stabilize the polymer's unstable endgroups by fluorination instead of melt-kneading the polymer in step (B). Pet. 32. In the testimony relied upon by Petitioner, Dr. Iezzi refers to the Kaulbach reference discussed at length in Section II.D.1. above. *Id.* (citing Ex. 1002 ¶ 138). For the same reasons set forth in Section II.D.1., however, we are not persuaded that the skilled artisan would have viewed alkali metal salts—such as those that may be intentionally added during polymerization (Ex. 1009, 4:27–34), or used to stabilize unstable endgroups of a polymer (Ex. 1025 ¶¶ 17, 48)—as a contaminant to be avoided. Here again, we emphasize that although Kaulbach does express a preference for an alkali metal salt free polymerization recipe, Kaulbach does not explain the reason for this preference. Ex. 1009, 4:45–46. Furthermore, Hiraga itself does not treat alkali metals as contaminants to be avoided, but rather intentionally adds them as preferred accelerators of the stabilization reaction. Ex. 1025 ¶ 17. Third, Petitioner argues that the skilled artisan would have been motivated to substitute Hiraga's wet-heat method of stabilizing the fluoropolymer at step (B) with a fluorination process because "fluorination provides benefits compared to other stabilization techniques, such as Hiraga's wet-heat treatment." Pet. 32. Petitioner points to evidence of record that purportedly demonstrates that "fluoropolymers with endgroups stabilized using fluorination have better electrical properties than those treated using different means." *Id.* at 33 (citing Ex. 1027 ("Piekarski"), 2:6–11, 3:34–39, 3:53–54). Specifically, Petitioner avers that Piekarski teaches "that functional endgroups, like –CF_2H groups that are formed during wet-heat stabilization,[9] are responsible for dielectric loss at high frequencies leading to poorer electrical properties." *Id.*

We are not persuaded, however, that Piekarski's disclosure would have motivated the skilled artisan to eliminate Hiraga's melt-kneading stabilization step, and completely replace it with a fluorination process to stabilize the unstable endgroups. We note that Petitioner tries to make a case here that claims 3 and 4 of the '431 patent would have been obvious based on Hiraga alone, but also relies (indirectly) upon the teachings of Piekarski, which discloses several methods for improving the dissipation factor of FEP copolymers, both at high and low frequencies. Ex. 1027, 2:6–11, 3:34–39, 53–54.

In our view, Petitioner's reliance on Piekarski's disclosure, without more, does not explain sufficiently how such omission of Hiraga's melt-kneading step could have been accomplished because, in

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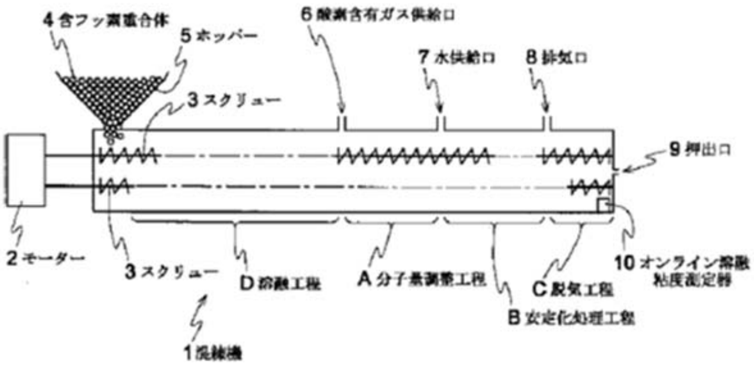
[9] *See* Ex. 1025 ¶ 4 (explaining that unstable end groups can be "treated in the presence of water and heat and thus are converted to stable –CF_2H groups").

Comparative Example 1, molecular weight adjustment and endgroup stabilization are being carried out *simultaneously* by melt-kneading. Ex. 1025 ¶¶ 107–118. Specifically, Hiraga explains that the twin screw extruder used as the melt-kneader has several zones, including "molecular weight adjustment zone (A)" and "stabilization treatment zone (B)." *Id.* ¶ 108. Hiraga's extruder is depicted in Figure 1:

FIG. 1



Hiraga's Figure 1 "is a schematic cross-sectional view of an extruder" 1, containing motor 2, screw 3, fluorine-containing polymer 4, hopper 5, oxygen-containing gas supply port 6, water supply port 7, exhaust port 8, extrusion port 9, molecular weight adjustment zone A, stabilization zone B, deaeration zone C, and melt zone D. Ex. 1025 ¶¶ 75, 120, Fig. 1.

Hiraga explains that molecular weight adjustment, i.e., step (A), is first carried out by melt-kneading the fluorine-containing polymer "in the presence of an oxygen-containing gas such as air." *Id.* ¶ 30. In Hiraga's Figure 1, the oxygen-containing gas supply port 6 is situated at the beginning of molecular weight adjustment zone A. *Id.* at Fig. 1. Hiraga further instructs that "unstable groups of the fluorine-containing polymer cannot be stabilized by the presence of the oxygen alone and, as such, . . . [it] is melt-kneaded in the presence of oxygen while further aggressively introducing water." *Id.* ¶ 41. Water supply port 7 is situated between molecular weight adjustment zone A and stabilization treatment zone B. *Id.* at Fig. 1. In Comparative Example 1, Zones A and B "were not partitioned," were at the same temperature, and the air and water were simultaneously supplied. *Id.* ¶ 114. Based on this disclosure, it is not clear how Petitioner's proffered modification of Hiraga's Comparative Example 1 could have been carried out, because the lack of partitioning would render difficult if not impossible Petitioner's proposed modification involving only the process carried out in zone B.

Moreover, the evidence upon which Petitioner indirectly relies, i.e., Piekarski, appears to allow for up to 50 endgroups per million carbon atoms other than $–CF_3$ in the copolymer to achieve the purported improvement in electrical properties. Pet. 33; Ex. 1027, 3:42–43. On the fully developed record, however, Petitioner has not provided sufficient evidence that establishes Hiraga's Comparative Example 1—after molecular weight adjustment step (A)—has 50 or more terminal groups other than $–CF_3$.[10] In fact, Hiraga does not measure Comparative

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[10] The $–CF_2H$ endgroups at issue in this challenge are repeatedly referred to in the record as "stable" or "highly stable." Ex. 1002 ¶ 160; Pet. 11; Ex. 1025 ¶ 4; Ex. 1007, 2:65–67, 3:4–5, 5:10; Ex. 1010, 5:37–38, 44–46; Ex. 2017, 3:30–33. Piekarski discloses that another type of stable endgroup, $–CF_3$, is desired, and

Example 1's endgroups in this manner, but rather focuses on *unstable* endgroups, and appears to measure those endgroups only *after* the stabilization process is complete. Ex. 1025 ¶¶ 115–117.

Even if Petitioner provided such evidence, however, Hiraga already teaches the possibility of fluorination after stabilization via melt-kneading. Ex. 1025 ¶ 50; Ex. 1027, 3:34–43; Pet. 33; Ex. 1002 ¶ 139. Thus, on the fully developed record before us,[11] Petitioner has not established that the skilled artisan would have been motivated to completely eliminate Hiraga's stabilization via melt-kneading at step (B) in favor of a fluorination step that Hiraga already teaches may be carried out *after* both melt-kneading steps (A) and (B). Ex. 1025 ¶ 50. It follows that we are not persuaded that the skilled artisan would have been motivated to eliminate the alkali metal salt used in Hiraga's melt-kneading stabilization step (B)[12] to yield a FEP polymer with an alkali metal ion concentration falling within the ranges recited in claims 3 and 4 of the '431 patent. Therefore, Petitioner has not established that

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therefore seeks to limit the total amount of *any* other endgroup, including stable $-CF_2H$ groups, to a value of less than 50 per million carbon atoms. Ex. 1027, 3:34–43, 3:53–54.

[11] Petitioner objected to certain arguments regarding this ground made by Patent Owner in the Sur-Reply as being waived. Sur-Reply 14–18; Paper 48, 1–2; Paper 50, 4–7. Because we expressly do not rely on Patent Owner's Sur-Reply arguments in reaching our Decision, we need not substantively address Petitioner's waiver argument. Petitioner's Motion to Exclude these arguments is likewise moot. Paper 50, 4–7.

[12] Hiraga adds alkali metal salts as a catalyst during stabilization via melt-kneading. Ex. 1025 ¶¶ 17, 45, 48, 63; *see also* Ex. 2010, 43:6–20, 45:19–46:2 (Dr. Iezzi testifying that alkali metal salts in Hiraga are added during polymer stabilization).

claims 3 and 4 of the ’431 patent are unpatentable over Hiraga.

3. Asserted Anticipation and/or Obviousness Based on Kono

Petitioner asserts that Kono anticipates and/or renders obvious claims 3 and 4 of the ’431 patent. Pet. 44 45, 49–50; *see also id.* at 35–44 (discussing the purported anticipation of now disclaimed claim 1, from which claims 3 and 4 depend).

a. Anticipation Analysis[13]

Petitioner relies on Kono’s Example 2 and Comparative Example 3 to establish anticipation of claims 3 and 4. Pet. 42–45. Kono’s Example 2 polymer has a total of 58 measured endgroups: 3 –COF groups, 2 –COOH groups, and 53 $–CH_2OH$ groups. Ex. 1008, 10, Table 1. Kono’s Comparative Example 3 polymer has a total of 50 measured endgroups: 3 –COF groups, 1 –COOH group, and 46 $–CH_2OH$ groups. *Id.* The polymers of Example 2 and Comparative Example 3 employ the use of methanol as a chain transfer agent “to adjust the molecular weight.” *Id.* at 13:7–10, 14:20–25; 12:34–36. Petitioner’s evidence establishes, however, that “[i]f a molecular weight modifier such as methanol is employed, then a portion of the ends may be carbinol ($–CH_2OH$) as well as the more stable difluoromethyl ends ($–CF_2H$). The *presence of*

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[13] Our anticipation analysis does not rely on Patent Owner’s arguments regarding this ground as set forth in the Sur-Reply. Such arguments are objected to by Petitioner as being waived. Sur-Reply 14–17; Paper 48, 1–2; Paper 50, 4–7. Because we do not need to rely on Patent Owner’s Sur-Reply arguments regarding this challenge, we need not substantively address Petitioner’s waiver argument.

methanol can also lead to methyl ester ends ($–CO_2CH_3$)." Ex. 1010, 5:35–39 (emphasis added).

Petitioner expressed a concern that our Institution Decision applied our construction of "unstable endgroups" too restrictively by requiring Kono to account for endgroups that may not form under the disclosed synthesis conditions. Applying our "unstable endgroups" construction in a way that would include only the unstable endgroups that would be "expected" based on the polymer's synthesis, Kono falls short of anticipating claims 3 and 4 of the '431 patent because it does not measure methyl ester endgroups. Ex. 1008, 12:57–60. On this point, Petitioner advances an argument that "Dr. Iezzi opines that methyl esters are not detected when methanol is used as a chain transfer agent. (Ex. 1002 ¶ 57 (citing Ex. 1019, 1:53–57).)." Reply 13. We are not persuaded by this argument, however, because neither Dr. Iezzi's testimony nor the relied upon evidence appear to speak in absolute terms regarding the formation of methyl ester groups when using methanol as a chain transfer agent. Here, Dr. Iezzi states that the skilled artisan "would have understood that use of methanol as a chain transfer agent during polymerization *can result* in the formation of $–CF_2CH_2OH$ and $–COF$ endgroups in the fluoropolymer. Ex. 1019, 1:53–57." Ex. 1002 ¶ 57 (emphasis added). Because Dr. Iezzi does not expressly state $–CF_2CH_2OH$ and $–COF$ are the only endgroups that would result from using methanol as a chain transfer agent, however, we do not view his testimony as restricting the expected endgroups to include only $–CF_2CH_2OH$ and $–COF$. Significantly, the evidence upon which Dr. Iezzi relies also does not definitively address the presence or absence of methyl ester groups when using methanol as a chain transfer agent. *See* Ex. 1019, 1:53–57 ("If methanol is used as the chain transfer agent, $–CF_2H$ and $–CF_2CH_2OH$ end groups will also be present.").

Therefore, weighing the evidence before us on this point, one reference specifically mentions that methyl ester endgroups may form in "[t]he presence of methanol" when it is used as a "molecular weight modifier"—which is precisely how Kono appears to use methanol in Example 2 and Comparative Example 3. Ex. 1010, 5:35–39; Ex. 1008, 12:34–36, 13:7–10, 14:20–25. On the other hand, Dr. Iezzi lists endgroups that "can" form when methanol is used as a chain transfer agent, but does not definitively state such endgroups are the *only* ones that would be expected when using methanol in this manner. Ex. 1002¶ 57. Petitioner's evidence similarly mentions possible endgroups when methanol is used as a chain transfer agent, but does not foreclose the possibility of methyl ester endgroups forming. Ex. 1019, 1:53–55.

Thus, on balance, the record evidence that expressly discloses a nexus between using methanol as a molecular weight modifier and the formation of methyl ester endgroups outweighs Petitioner's relied-upon evidence and Dr. Iezzi's silence on this key point. Ex. 1010, 5:35–39; Ex. 1002 ¶ 57; Ex. 1019, 1:53–55.

In sum, because the evidence of record supports a conclusion that methyl ester endgroups would be expected to form when using methanol as a molecular weight modifier during FEP synthesis, and because Kono does not measure such methyl ester endgroups, Petitioner has not established by a preponderance of the evidence that Kono's Example 2 and Comparative Example 3 anticipate claims 3 and 4 of the '431 patent.

b. *Obviousness Analysis*

In the alternative, Petitioner asserts that claims 3 and 4 of the '431 patent are rendered obvious in view of Kono. Pet. 49–50. In support of its obviousness challenge, Petitioner relies on the same general disclosure of Kono as in its anticipation challenge, and additionally relies on Kono's Comparative Example 5 as well as Kono's disclosure of a fluorination process. *Id.* (citing Ex. 1002 ¶¶ 183–187).

i. Stabilization via fluorination over wet-heat treatment

Petitioner relies on purported benefits of fluorination to provide the motivation to stabilize the endgroups in Example 2 and Comparative Examples 3 and 5 via fluorination instead of other stabilization methods such as the wet-heat treatment used in Comparative Example 5. Pet. 49–50. Specifically, Petitioner argues that fluorination results in "better electrical properties obtained by converting $–CF_2H$ endgroups to $–CF_3$ endgroups." Pet. 50 (citing Ex. 1002 ¶ 185; Ex. 1027, 3:35–38). Petitioner also notes that fluorination "was commonly used to remove unstable endgroups." Pet. 49.

On the fully developed record, Petitioner has not established by a preponderance of the evidence that it would have been obvious for the skilled artisan to employ fluorination instead of wet-heat treatment. Petitioner's assertion that fluorination "was commonly used," without more, is insufficient to establish the obviousness of the proffered substitution of stabilization methods. *See KSR*, 550 U.S. at 418 (explaining "there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness") (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)); *see also Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015) ("[O]bviousness concerns whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of prior art to arrive at the claimed invention.") (emphasis in original).

Furthermore, the articulated reasoning that Petitioner does provide to support the proffered substitution—i.e., the purported benefits of fluorination over wet-heat stabilization—falls short. Petitioner does not allege, much less provide evidence to persuasively establish, that any of Kono's Example 2 or Comparative Examples 3 and 5 individually have 50 or more terminal groups other than $-CF_3$, which appears to be the maximum number of such endgroups allowed in order to realize the purported beneficial electrical properties relied on by Petitioner. *See* Ex. 1027, 3:40–43 (explaining how "the polymer should have fewer than about 50 and preferably fewer than about 20 [end groups other than $-CF_3$] per million carbon atoms"). Kono does not measure endgroups in this manner, but rather focuses on three specific unstable endgroups. Ex. 1008, 12:57–59, 18:16–20. In the absence of such evidence, Petitioner has not established sufficiently that the skilled artisan would have had a reason to omit the wet-heat stabilization method employed in Kono's Comparative Example 5 and replace it with a fluorination process.

Furthermore, Petitioner has not established that the skilled artisan would have applied any stabilization process such as fluorination to Example 2 and Comparative Example 3, because Kono discloses that a certain limited number of unstable endgroups, i.e., "adhesion terminus groups," are beneficial and desired. Ex. 1008, 5:1–33 (explaining how functional groups in the FEP "can be changed to contribute to increased adhesion with the core wire," and how the total number of –COF, –COOH, and –CH_2OH groups may be between 15 and 150). Kono discloses that the "adhesive strength" between the polymer and the core wire should be "0.8 kg or more." *Id.* at 3:16–17, 4:48–51. Kono's Example 2 has 58 –COF, – COOH, and –CH_2OH groups and exhibits an adhesion strength of 1.5 kg at an extrusion speed of 2800 ft/min and is described as being "superior." *Id.* 15:50–57, Table 1. Comparative Example 3 has 50 such groups and exhibits a somewhat inferior adhesive strength of 1 kg at 2800 ft/min. *Id.* Here, we emphasize in particular how close the Comparative Example 3 FEP's adhesive strength is to the 0.8 kg minimum threshold taught by Kono. *Id.* at 3:16–17, 4:48–51. It is not clear on this record why the skilled artisan would have been motivated to potentially decrease the "superior" adhesion strength of the Example 2 FEP or the lower adhesive strength of the Comparative Example 3 FEP, by stabilizing the –COF, –COOH, and –CH_2OH groups that Kono teaches may "contribute to increased adhesion with the core wire." *Id.* at 5:1–33; *see also id.* at 2:10–15 (explaining how completely fluorinated FEP copolymers have inferior adhesion properties and suffer "severe shrink-back.").

ii. Modification of Comparative Example 5's MFR

Petitioner acknowledges that Comparative Example 5 fails to meet the melt flow rate ("MFR") limitation recited in claims 3 and 4. Pet. 40 ("Under the proper BRI construction . . . 35.1 g/10 min is outside the literal scope of "about 30±3 g/10 min"). Petitioner asserts, however, that "the overlapping MFR range[] disclosed in Kono and the closeness of Comparative Example 5's MFR to claim 1's range supports a *prima facie* case of obviousness." *Id.* For support, Petitioner points to Kono's general disclosure of an MFR range of 30–45 g/10 min, and alleges the skilled artisan "would have been able to optimize the reagents and reaction conditions taught in Kono's Comparative Example 5" to meet the recited range through routine experimentation. *Id.*

We disagree with Petitioner that it would have been obvious to decrease Comparative Example 5's MFR of 35.1 g/10 min to fall within the scope of the recited range of "30±3 g/10 min." Here, we note that Comparative Example 5's MFR already falls within Kono's preferred and "more prefer[red]" MFR ranges of "30 (g/10 min.) or more" and "30 to 45 (g/10 min.)," respectively. Ex. 1008, 6:12–13, 6:26–27, 18:13. Moreover, and quite significantly, Kono disparages MFRs below 30 g/10 min, which the recited range of "30 ± 3" includes, because such MFR values may cause melt fracture to become severe, resulting in cone-breaks and spark-out. *Id.* at 6:21–25. Indeed, Comparative Example 5 has a higher MFR (35.1 g/10 min) than does Example 7 (34.5 g/10 min) and exhibited fewer "spark-outs" at all speeds measured vis-à-vis Example 7. *Id.* at 18:21–32. Thus, it is not clear on this record why the skilled artisan, based on the teachings of Kono, would have had a reason to decrease Comparative Example 5's MFR at all, much less to the recited range of 30±3 g/10 min.

Petitioner's reliance on Dr. Iezzi's opinion that it would have been obvious to decrease Comparative Example 5's MFR does not persuade us otherwise, because the evidence relied upon by Dr. Iezzi (Ex. 1032 ¶¶ 11) lacks sufficient specificity. Ex. 1002 ¶¶ 163–164. Namely, the relied-upon evidence generally refers to melt flow rates that are "too small" and "too large" without providing specific MFR values. *See* Ex. 1032 ¶ 11 (stating "[w]hen MFR is too small, the FEP copolymer has a high molecular weight so that some adjustment of the molding conditions such as increase of a melt temperature is necessary" and "[w]hen MFR is too large, the FEP copolymer has a low molecular weight so that decomposed materials of the copolymer may be formed."). The next paragraph in that evidence, however, provides relevant details on this point, stating "[f]rom these viewpoints, MFR (372°C, 5,000 g load) is from 10 to 35 g/min,[14] preferably from 15 to 30 g/10 min." *Id.* ¶ 112. Thus, the relied-upon evidence discloses that MFR values can be as high as 35 g/10 min, which is significantly close to Kono's Comparative Example 5's MFR of 35.1 g/10 min. *Id.*; Ex. 1008, 18:13. The evidence also appears to contradict Kono's teachings, in that the evidence prefers MFR values that Kono disparages.

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[14] This appears to be a typographical error in the MFR units as evidenced by other repeated recitations of "g/10 min" throughout the same evidence. Ex. 1032, code (57), ¶¶ 6, 12, 24, 48, 56, 59, 63, 67, 71.

Compare Ex. 1032 ¶ 12 (preferring MFR values "from 15 to 30 g/10 min") *with* Ex. 1008, 6:21–25 ("[i]f the MFR is less than 30 (g/10 min), the extent of melt fracture becomes severe, cone-breaks or spark-out due to melt fracture may be observed in some cases, and it tends to be difficult to increase the coating speed."). Thus, we are not persuaded Petitioner has demonstrated sufficiently that the skilled artisan would have been motivated to decrease the melt flow rate of Comparative Example 5 to be within the recited range of "30±3 g/10 min."

In sum, Petitioner has failed to establish by a preponderance of the evidence that claims 3 and 4 of the '431 patent would have been obvious over Kono.

4. Asserted Obviousness Based on Kaulbach

Petitioner asserts that claims 3 and 4 of the '431 patent are obvious in view of Kaulbach. Pet. 50–57 (citing Ex. 1002 ¶¶ 188–211). Petitioner relies on Sample A11 of Kaulbach and alleges that "([i]n Sample A11, Kaulbach discloses a copolymer that renders obvious each and every limitation of claims [3 and 4] of the '431 patent." *Id.* at 51. Petitioner sets forth a detailed explanation of how Kaulbach's Sample A11 purportedly meets or renders obvious the recited limitations. *Id.* at 52–57.

Specifically, Petitioner asserts that Kaulbach's Sample A11 is "[a] partially-crystalline copolymer" that "contains 87% by weight TFE and 13.0% by weight HFP" and "has an HFPI of 4.1." Pet. 52. Petitioner asserts that Kaulbach's copolymer has "less than about 50 ppm alkali metal ion" because Kaulbach's preferred polymerization recipe is "alkali metal salt-free" and is otherwise "silent regarding use or presence of alkali metal salt in obtaining Sample A11." *Id.* at 53; *see also id.* at 57 (noting that "[b]ecause there is no indication of the use or presence of alkali metal in Sample A11, it would have less than . . . 10, and 5 ppm alkali metal ion" as set forth in claims 3 and 4, respectively).

Petitioner avers that although Sample A11 has a melt flow rate[15] of 24 g/10 min[16], it would have been obvious to modify Sample A11's melt flow rate to be within the claimed range of 30±3 g/10 min, because "Kaulbach teaches that the copolymers should have an MFR of 15 g/10 min or higher" and "does not provide an upper limit on the MFR range." Pet. 54. Thus, according to Petitioner, the claimed range "falls within Kaulbach's express range." *Id.* Petitioner asserts further that the skilled artisan "would have been motivated to modify Sample A11 to increase the MFR

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[15] Kaulbach refers to a "melt flow index" or "MFI" value. Ex. 1009, 1:40–41, 3:43–44. Patent Owner appears to acknowledge that "melt flow index" and "melt flow rate" may be used interchangeably. *See, e.g.*, PO Resp. 27 (stating how Kaulbach "discloses a target MFI (or melt flow rate) of his polymer, and teaches the melt flow rate should remain unchanged"); *see also id.* at n.9 (assuming "that MFI and MFR are synonymous"). Thus, for purposes of this Final Decision, we treat the recited "melt flow rate" and Kaulbach's "melt flow index" as interchangeable phrases describing the same parameter.

[16] The parties agree that Kaulbach incorrectly reports melt flow rate in units of g/min rather than in g/10 min. Pet. 53 n.8; PO Resp. 27, n.8; *see also* Ex. 1002 ¶ 89 (Dr. Iezzi testifying that reading Kaulbach's units as g/min literally "is nonsensical, and would be recognized as such by a POSA"). Under these circumstances, and for purposes of this Final Decision, we treat Kaulbach's disclosure of melt flow rate in units of "g/min" as "g/10 min."

to meet Kaulbach's goal of providing 'a material . . . which can be processed at higher speeds'" because "[i]t was well known at the time of the '431 patent that the higher the MFR of the FEP-coploymer, the higher the speeds at which the copolymer can be processed." *Id.* Petitioner points to Kono as evidence that coating extrusion speed can be increased by increasing the polymer's MFR, and that MFR values below 30 g/10 min are not preferred because "melt fracture ('cone-breaks') can become severe, coating flaws may be observed, and increasing coating speed is difficult." *Id.* at 54–55 (citing Ex. 1008, 6:12–25). Finally, Petitioner points to Kaulbach's disclosure that Sample A11 has "28 endgroups" selected from –COOH, –$CONH_2$ and –COF groups, and states "[g]iven Kaulbach's polymerization and processing techniques and the reagents employed therein, no other unstable endgroups would be present in the copolymer of Sample A11." *Id.* at 55 n.9 (citing Ex 1002 ¶ 205).

Kaulbach expressly discloses an example FEP having a melt flow rate of 24 g/10 min. Ex. 1009, 3:48–50, 8:59–60. Kaulbach also discloses that, to carry out "high speed wire extrusion the MFI of the polymer is ≥ 15."[17] *Id.* at 3:42–43. Other evidence of record indicates FEP copolymers having MFR values of up to 50 g/10 min when "coating at a high speed," with values of 30–45 g/10 min being preferred because such MFR values enable coating speeds of 2800 ft/min or

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[17] We note this disclosure of Kaulbach does not expressly recite the MFI, i.e., "MFR" units. Ex. 1009, 3:43–44. Because Patent Owner does not allege otherwise, but rather appears to concede Kaulbach's units are "g/10 min" (Sur-Reply 2), we treat Kaulbach's disclosure of "≥ 15" as a disclosure of "greater than or equal to 15 g/10 min" for purposes of this Final Decision.

more. Ex. 1008, 6:12–28, 5:51–55; *see also id.* at 6:21–25 ("If the MFR is less than 30 (g/10 min.), the extent of melt fracture becomes severe, cone-breaks or spark-out due to melt fracture may be observed in some cases, and it tends to be difficult to increase the coating speed."); Ex. 1006, 2:17–25 (describing fluoropolymers with MFR values from 15–50 g/10 min as "special" because they are "capable of high speed extrusion, but [] also exhibit[] excellent physical properties, characterized by high flex life"); *id.* at 3:13–17 (explaining that an extrusion speed of up to 3000 ft/min "is achieved by the fluoropolymer preferably having a melt flow rate of about 15 g/10 min to 50 g/10 min").

The evidence of record establishes, and Patent Owner acknowledges (PO Resp. 23), that increasing MFR was a way to achieve higher coating speeds. Ex. 1002 ¶ 201 (Dr. Iezzi stating that "[i]t was well known and disclosed in the art as of the priority date of the '431 patent that the higher the MFR (or the lower the viscosity) of an FEP-copolymer, the higher the speeds at which the copolymer can be processed"); Ex. 1008, 2:51–53 ("In order to increase the speed of the coating extrusion, it is generally preferred to reduce the melt viscosity of the resin"); *see* Ex. 2006 ¶¶ 31–32 (Dr. Mecham explaining how MFR "is inversely related to melt viscosity and molecular weight," that "the lower the melt viscosity and molecular weight of an FEP, the higher its MFR," and "the higher the MFR, the faster the polymer could be coated onto a wire"); *see also* Ex. 1038, 88:20–22 (Dr. Mecham stating that "[t]here's a general concept that if you have a higher MFR, you can process faster than if you have a lower MFR"). We also note

Kaulbach's express desire for "[h]igh processing speeds . . . when wires and cables are extrusion coated." Ex. 1009, 1:29–30.

The evidence also establishes, however, that increasing MFR, i.e., lowering the melt viscosity, too much may negatively impact coating quality by, e.g., decreasing the polymer's resistance to stress cracking. Ex. 1008, 2:53–54; Ex. 1006, 1:32–40 (explaining how "melt viscosity of the polymer is a factor that limits the line speed" at which the wire is coated because, "[a]s line speed is increased, a point is reached at which the appearance and quality of the coating begin to deteriorate" and manifests as "surface roughness, variation in coating thicknesses, such as lumps of polymer at intervals along the wire, and defects in the insulating quality of the coating, known as 'sparks'").

Thus, the evidentiary record supports the general proposition that increasing the melt flow rate of a FEP copolymer may yield a desired increase in the speed at which a wire can be coated. The evidence also supports that melt flow rates of up to 50 g/10 min are suitable for such high speed wire coating applications for speeds up to 3000 ft/min.

Turning back to Kaulbach's Sample A11 copolymer, we note it exhibited no "noticeable die drools and no cone-breaks" when coating a wire at line speeds of 1710 and 2006 feet per minute. Ex. 1009, 9:1–22. In another wire coating test, it "did not show noticeable die drool and exhibited only 2 cone-breaks during a period of 29 hours of extruding" various wire colors at a speed of 1700 ft/min. *Id.* at 9:34–47, 10:7–9. In view of Kaulbach's disclosure that MFR values of ≥ 15g/10 min are suitable for high speed wire extrusion, and record evidence establishing that higher coating speeds of 2800 or 3000 ft/min are possible, we are persuaded that the skilled artisan would have been motivated to improve upon the wire coating speeds observed with Kaulbach's Sample A11. We also are persuaded that the skilled artisan would have been motivated to increase the MFR of Kaulbach's Sample A11 to be within the recited range in order to achieve higher processing speeds, because the evidence of record teaches that achieving such speeds may be possible by increasing a FEP copolymer's MFR.

We disagree with Patent Owner that Kaulbach discloses an "unbounded" range of MFR values in its disclosure of ≥ 15 g/10 min, thus encompassing "an infinite number of polymers, with melt flow rates of 50, 100, 1000, 10,000 and even higher," because assessing the true scope of a prior art reference requires viewing it through the eyes of the person of ordinary skill. PO Resp. 28 (citing Ex. 2006 ¶ 58); *see In re Rouffet*, 149 F.3d 1350, 1357 (Fed. Cir. 1998) ("Obviousness is determined from the vantage point of a hypothetical person having ordinary skill in the art to which the patent pertains.").

Record evidence on this point does not support that the skilled artisan would have viewed Kaulbach's MFR disclosure of ≥ 15 g/10 min in the manner argued by Patent Owner. Rather, the evidence suggests the skilled artisan would have viewed Kaulbach's disclosure as imposing a practical maximum limit on a polymer's melt flow rate. *See* Ex. 1008, 2:51–54 ("In order to increase the speed of the coating extrusion, it is generally preferred to reduce the melt viscosity of the resin. On the other hand, *resistance to stress cracking of the resin decreases because of the lowered* *melt viscosity*" (emphasis added)); Ex. 1006, 3:21–27 (explaining how manufacturing "high melt flow rate fluoropolymers is not only a matter of reducing molecular weight," because the polymer's physical properties "are strongly dependent upon molecular weight," and, by extension, melt flow rate). In other words, the prior art teaches that the melt flow rate cannot be increased too much, because doing so would negatively impact the physical properties of the coating, such as its resistance to stress cracking.

Moreover, the parties agree the skilled artisan would have understood there is a "practical maximum" to the melt flow rate parameter, because at some point it becomes too high to effectively coat a wire. Ex. 2006 ¶ 58 (Dr. Mecham stating the skilled artisan "would understand that there is a practical maximum to the MFR of Kaulbach's polymer" because "[a]t some MFR, Kaulbach's FEP would have too low of a melt viscosity, such that it could not be processed at any speed, much less at high speeds"); Ex. 1038, 136:6–11 (Dr. Mecham testifying that "Kaulbach's open-ended MFR range would include all kinds of polymers that had MFRs higher than what he discloses as 24, and anyone who is skilled in the art would understand that there's a maximum to that"); PO Resp. 29; *see also* Ex. 1002 ¶ 89 (Dr. Iezzi stating "an MFR value of 24 g/min would convert to a value of 240 g/10 min, which is nonsensical, and which would be recognized as such by a POSA").

Thus, the evidence of record establishes the skilled artisan would not have understood Kaulbach's MFR range of ≥15 g/10 min to be "unbounded," but rather would have viewed such disclosure to be a "closed" MFR range, between 15 g/10 min and the "practical maximum" value depending on the fluoropolymer's overall composition and processing parameters.[18]

We also do not agree with Patent Owner's arguments that the skilled artisan would not have been motivated to increase Sample A11's melt flow rate to be within the claimed range because doing so would broaden its molecular weight distribution ("MWD") against Kaulbach's teachings. PO Resp. 3, 23–27, 29, 31–34; Sur-Reply 2, 3, 9–14. Indeed, Kaulbach is vague regarding how "narrow molecular weight distribution" is defined. Although Kaulbach discloses "a *very narrow* molecular-weight distribution, i.e., a ratio of Mw to Mn of less than about 2 (Mw=weight average, Mn=number average molecular weight)" which "may be as low as 1.5," Kaulbach does not then precisely define what it considers to be "narrow" or "broad" distributions along the molecular weight distribution spectrum. Ex. 1009, 3:35–38 (emphasis added). Here, we note Sample A11's measured MWD value was 1.6, thus seemingly falling within Kaulbach's "very narrow" MWD range of 1.5 to less than about 2. *Id.* at 8:62–63; 3:35–38. Because Kaulbach does not specifically set forth numerical limits on the Mw/Mn ratios that constitute

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[18] Dr. Mecham testifies that the maximum MFR value in a given process which "yield[s] an adequate coating" depends on a number of parameters such as the polymer's monomer composition and molecular weight distribution, and the processing conditions such as temperature and pressure. Ex. 1038, 83:7–84:10. Dr. Iezzi testifies that while Kaulbach does not disclose the maximum MFR, "[t]here would be some upper limit . . . that could be 100, could be 150, could be high, well above" the 24 g/10 min provided for Sample A11. Ex. 2010, 77:7–20.

"narrow" and "broad" molecular weight distributions, it is plausible that the skilled artisan may have been able to slightly increase Sample A11's MFR of 24 g/10 min to be within the claimed range, and still end up with a "narrow" MWD polymer as suggested by Kaulbach, even if that meant slightly "broadening" Sample A11's MWD.

In any event, the skilled artisan would not have been constrained to follow only Kaulbach's teachings regarding a "narrow" molecular weight distribution from the entire universe of prior art when considering how to increase the coating speed of Kaulbach's Sample A11. Rather, the person of ordinary skill would have considered *all* the available knowledge at his or her disposal regarding how to accomplish a higher coating speed, including increasing Sample A11's MFR. On this point, record evidence supports the proposition that broad molecular weight distribution polymers have certain benefits, such as high strength. *See* Ex. 1038, 92:19–93:2 (Dr. Mecham testifying "if you have a broader molecular-weight distribution, you have a higher composition of – or a higher fraction of high-molecular weight materials, that's going to strengthen the material more than if you had a narrow distribution where you didn't have that high fraction"); *Id.* at 171:5–12 (Dr. Mecham testifying that increasing MFR without broadening the molecular weight is problematic and may lead to a polymer with poor strength and poor processing conditions); *see also* PO Resp. 24 ("Broadening the molecular weight distribution of an FEP allows one to create a polymer with enough low molecular weight chains to keep the melt viscosity low, but also enough high molecular weight chains to *boost the mechanical* *properties, stability, and insulation quality of the final coating."* (citing Ex. 2013, 2:60–3:2; Ex. 2012, 44, 63) (emphasis added)).

Furthermore, Patent Owner admits that maintaining a narrow molecular weight distribution in the copolymer magnifies "[t]he drawbacks and challenges of increasing melt flow rate" because "the polymer chains have a narrower range of length and molecular weight." PO Resp. 31. Thus, according to Patent Owner, "to increase Kaulbach's melt flow rate to within the claimed range *but retain its narrow distribution*, one would have to decrease the molecular weight of all of the polymer chains," which "would magnify the problems of high melt flow rate products (e.g., decreased mechanical and physical properties) and likely result in an unusable coating." *Id.* at 31–32 (emphasis added); *see also* Ex. 1038, 136:13–15 (Dr. Mecham testifying that increasing Kaulbach's MFR "any higher than [] 24 [g/10 min] is risky *with that narrow molecular weight distribution.*'" (emphasis added)). Due to the potential problems associated with keeping the molecular weight distribution narrow, then, it is not clear on this fully developed record why the skilled artisan would have been motivated to maintain such a narrow molecular weight distribution when seeking to achieve even higher coating speeds with Kaulbach's Sample A11.

On this point, Kaulbach states that "a narrow molecular weight distribution performs better" at achieving high processing rates than polymers with "broad" molecular weight distributions. Ex. 1009, 3:59–65. This portion of Kaulbach's disclosure, however, lacks specificity regarding what is deemed "narrow" and "broad." Furthermore, this general statement does not seem to apply to the specific Sample A11 copolymer which achieved processing speeds of 1710, 2006, and 1700 feet per minute (Ex. 1009, 9:1–47 (Tables 3 and 4)—speeds that are significantly lower than those achieved by Kono's process, which Patent Owner and Dr. Mecham admit uses a "broad" molecular weight distribution. PO Resp. 33; Ex. 2006 ¶ 65. Thus, even though Kaulbach generically touts that "high processing rates can be achieved" "[d]espite a narrow molecular weight distribution," (Ex. 1009, 3:59–60), this purported discovery would not have prevented the skilled artisan, at the time of the invention of the '431 patent, from considering other techniques—such as broadening the polymer's molecular weight distribution—to achieve higher coating speeds with Sample A11. Based on the evidence presented, we are persuaded that one such technique would have included increasing Sample A11's MFR from 24 g/10 min to the recited range of "about 30±3 g/10 min," even if doing so would have required broadening the molecular weight distribution of the polymer beyond the "narrow molecular weight distribution" suggested, but not required or precisely defined, by Kaulbach.

In sum, we are persuaded by Petitioner's arguments, evidence, and claim chart supporting its challenge that Kaulbach renders claims 3 and 4 of the '431 patent obvious. Pet. 50–57. More particularly, the preponderance of the evidence supports Petitioner's assertion that Kaulbach's Sample A11 polymer meets all of the limitations of claims 3 and 4, except for the melt flow rate limitation of "about 30±3 g/10 min." *Id.*; Ex. 1002 ¶¶ 188–197, 199–206, 208–211; Ex. 1009, 7:8–48, 8:57–9:47. For the reasons expressed above, however, Petitioner has persuaded us that the skilled artisan would have been motivated to increase the melt flow rate of Kaulbach's Sample A11 from 24 g/10 min to be within the range of "about 30±3 g/10 min" as recited in claims 3 and 4 in order to achieve higher wire coating speeds than those observed for Sample A11.

5. *Objective Indicia of Non-Obviousness*

Before we make a final obviousness determination, we must consider the evidence of obviousness in light of any evidence of secondary considerations of nonobviousness presented by Patent Owner. *See Graham*, 383 U.S. at 17–18 ("Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. As indicia of obviousness or nonobviousness, these inquiries may have relevancy."); *Transocean Offshore Deepwater Drilling, Inc. v. Maersk Drilling USA, Inc.*, 699 F.3d 1340, 1349 (Fed. Cir. 2012) ("This objective evidence must be 'considered as part of all the evidence, not just when the decisionmaker remains in doubt after reviewing the art.'" (quoting *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1538–39 (Fed. Cir. 1983))).

All types of objective evidence of nonobviousness must be shown to have a nexus to the claimed invention. *In re GPAC Inc.*, 57 F.3d 1573, 1580 (Fed. Cir. 1995) (nexus generally); *In re Huang*, 100 F.3d 135, 140 (Fed. Cir. 1996) (commercial success). The stronger the showing of nexus, the greater the weight accorded the objective evidence of nonobviousness.

See Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 306 (Fed. Cir. 1985), *cert. denied*, 475 U.S. 1017 (1986).

Patent Owner presents arguments directed to objective indicia of non-obviousness. PO Resp. 35–39. These objective indicia include unexpected results, commercial success, industry praise, and satisfaction of a long-felt but unmet need. *Id.*

a. Unexpected Results

To be particularly probative, evidence of unexpected results must establish that there is a difference between the results obtained and those of the closest prior art, and that the difference would not have been expected by one of ordinary skill in the art at the time of the invention. *Kao Corp. v. Unilever U.S., Inc.*, 441 F.3d 963, 970 (Fed. Cir. 2006). Patent Owner alleges that the combination of alkali metal salt concentration, melt flow rate, and number of unstable endgroups recited in claims 3 and 4 "unexpectedly results in a superior wire coating" that is "capable of high speed extrusion at lower extrusion temperatures, produces high quality coating over a broad polymer melt temperature range, and enjoys long extrusion runs without the need to shut down the extruder for cleaning." PO Resp. 35–36 (citing Ex. 1001, 1:59–65, 3:46–52). Patent Owner asserts the recited alkali metal salt and endgroup limitations "prevent[] degradation at severe operating conditions." *Id.* at 36 (citing Ex. 1001, 7:1–6, 6:36–43). Patent Owner also avers "the claimed FEP unexpectedly exhibits superior electrical properties as compared to prior art FEPs." *Id.* (citing Ex. 1001, 8:17–55).

We are not persuaded by Patent Owner's assertion of unexpected superior results. "[W]hen unexpected results are used as evidence of nonobviousness, the results must be shown to be unexpected compared with the closest prior art." *Baxter Travenol*, 952 F.2d at 392. Indeed, "[i]t is well settled that unexpected results must be established by factual evidence. Mere argument or *conclusory statements in the specification does not suffice.*" *In re De Blauwe*, 736 F.2d 699, 705 (Fed. Cir. 1984) (emphasis added). First, Patent Owner relies merely on general statements within the patent itself, rather than any data that compares the claimed invention to the closest prior art. Patent Owner's general statement that "the claimed FEP unexpectedly exhibits superior electrical properties as compared to prior art FEPs" fails to quantify the superior electrical properties of the claimed FEP, fails to identify the prior art FEPs or delineate their electrical properties, and fails to compare the two to provide the factual evidence required by case law.

Furthermore, the general statements that Patent Owner references are not commensurate in scope with the challenged claims. The only claims remaining in this proceeding are claims 3 and 4, which require less than about 10 ppm and less than about 5 ppm alkali metal ion, respectively. Ex. 1001, 10:19–22. None of the relied-upon disclosures discuss such low alkali metal ion concentrations, and thus cannot meet the requirements of "the established rule that 'objective evidence of non-obviousness must be commensurate in scope with the claims which the evidence is offered to support.'" *Allergan, Inc. v. Apotex Inc.*, 754 F.3d 952, 965 (Fed. Cir. 2014) (quoting *In re Tiffin*, 448 F.2d 791, 792 (CCPA 1971)).

b. Commercial Success

"When a patentee can demonstrate commercial success, usually shown by significant sales in a relevant market, and that the successful product is the invention disclosed and claimed in the patent, it is presumed that the commercial success is due to the patented invention." *J.T. Eaton & Co. v. Atl. Paste & Glue Co.*, 106 F.3d 1563, 1571 (Fed. Cir. 1997); *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1329 (Fed. Cir. 2016). "Demonstrating that an invention has commercial value, that it is commercially successful, weighs in favor of its non-obviousness." *WBIP*, 829 F.3d at 1337.

Patent Owner alleges that the FEP 9494 polymer, which Patent Owner asserts is encompassed by claims 3 and 4, is a commercial success because "FEP 9494 sales grew substantially after its introduction to the industry in 2005, and the revenue from sales of FEP 9494 since that time demonstrates the commercial success of the product." PO Resp. 36 (citing Ex. 2007 ¶¶ 10, 30–34, Declaration of John L. Hansen). Patent Owner states that "gross profit margins from FEP 9494 demonstrate that FEP 9494 is highly profitable, which is further indicative of its commercial success." *Id.* at 36–37 (citing Ex. 2007 ¶¶ 12, 35–37). Patent Owner also asserts that FEP 9494 "exceeded expectations in the marketplace and outperformed other fluoropolymer products," further evincing commercial success. *Id.* at 37 (citing Ex. 2007 ¶¶ 13, 38–41).

After considering the fully developed record evidence, we are not persuaded that Patent Owner's arguments and evidence regarding the FEP 9494 polymer's commercial success outweighs the obviousness of claims 3 and 4 of the '431 patent.

We begin with the required nexus inquiry. *See Ashland Oil*, 776 F.2d at 305 n.42 ("Case law requires that a nexus be established between the merits of the claimed invention and the evidence proffered on secondary considerations, if the evidence on secondary considerations is to be given substantial weight in the calculus of obviousness/nonobviousness"). The presumption of nexus between the proffered evidence and the merits of the claimed invention (*see J.T. Eaton*, 106 F.3d at 1571) is rebuttable, as "a patent challenger may respond by presenting evidence that shows the proffered objective evidence was 'due to extraneous factors other than the patented invention.'" *WBIP*, 829 F.3d at 1329 (quoting *Demaco Corp. v. F. Von Langsdorff Licensing Ltd.*, 851 F.2d 1387, 1393 (Fed. Cir. 1988)). Such evidence may include, for example, demonstrating the commercial success "is due to an unclaimed feature," or if such feature "was known in the prior art." *Ormco Corp. v. Align Tech., Inc.*, 463 F.3d 1299, 1312 (Fed. Cir. 2006); *see also Richdel, Inc. v. Sunspool Corp.*, 714 F.2d 1573, 1580 (Fed. Cir. 1983) (holding the claims obvious despite a purported showing of commercial success when the patentee failed to show the "commercial success [] its marketed system enjoyed was due to anything disclosed in the patent in suit which was not readily available in the prior art").

Here, we determine that insufficient nexus exists between the evidence surrounding FEP 9494 and the merits of challenged claims 3 and 4, because the claimed features were already disclosed in the prior art. Specifically, as set forth *supra* in our discussion regarding Kaulbach, Sample A11 satisfies all of the recited elements except for the melt flow rate limitation of "about 30±3 g/10 min." Ex. 1009, 8:57–65. Kaulbach, however, discloses melt flow rates of greater than or equal to 15 g/10 min being used for high speed wire extrusion which encompasses the claimed range. Ex. 1009, 3:42–43. Other evidence of record discloses FEP copolymers having MFR values of up to 50 g/10 min when "coating at a high speed," with values of 30–45 g/10 min being preferred because such MFR values enable coating speeds of 2800 ft/min or more. Ex. 1008, 6:12–28, 5:51–55; *see also id.* at 6:21–25 ("If the MFR is less than 30 (g/10 min.), the extent of melt fracture becomes severe, cone-breaks or spark-out due to melt fracture may be observed in some cases, and it tends to be difficult to increase the coating speed."); Ex. 1006, 2:17–25 (describing fluoropolymers with MFR values from 15–50 g/10 min as "special" because they are "capable of high speed extrusion, but [] also exhibit[] excellent physical properties, characterized by high flex life"); *id.* at 3:13–17 (explaining that an extrusion speed of up to 3000 ft/min "is achieved by the fluoropolymer preferably having a melt flow rate of about 15 g/10 min to 50 g/10 min"). In view of such express disclosure in the prior art, the claimed features were indeed known. Under such circumstances, we find an insufficient nexus between the proffered evidence and the merits of the claimed invention.

Moreover, even assuming there is sufficient nexus, we still find Patent Owner's evidence insufficient to establish commercial success. Specifically, Patent Owner does not provide sufficient evidence regarding FEP 9494's market share. First, Patent Owner does not make clear what it believes the relevant market to be, nor the size or volume of the relevant market. Instead, Patent Owner presents gross sales figures for FEP 9494, but such gross sales figures, particularly in the absence of a defined market, are inadequate to establish commercial success. *See Ex parte Jellá*, 90 USPQ2d 1009, 1012 (BPAI 2008) (precedential) ("[G]ross sales figures do not show commercial success absent evidence as to market share . . . or as to the time period during which the product was sold, or as to what sales would normally be expected in the market").

Even further, a proper commercial success analysis requires according the appropriate weight to any such evidence. When, as here, the patent itself may have precluded others from entering the relevant market, sales figures are weak evidence of commercial success. *See Merck & Co., Inc. v. Teva Pharm. USA, Inc.*, 395 F.3d 1364, 1376–77 (Fed. Cir. 2005) (explaining how financial success of a given product "is not significantly probative" of non-obviousness when "others were legally barred from commercially testing" them, and how "[b]ecause market entry by others was precluded on" the bases of patent protection and FDA-exclusivity, "the inference of non-obviousness . . . from evidence of commercial success, is weak.").

Patent Owner relies in part on various sales figures from 2005 through 2018 for FEP 9494 both in this proceeding as well as in a related proceeding, IPR2018–00992, challenging US Patent 7,122,609, issued October 17, 2006. Ex. 2007 ¶¶ 10, 30–34. In IPR2018–00992, Patent Owner states that FEP 9494 is covered by US Patent 7,122,609 B2. *See* IPR2018–00992 PO Resp. 37. Because FEP 9494 was covered by at least one patent from 2006–2011, and by at least two patents (US Patents 7,122,609 B2 and 8,076,431 B2) from 2011–2018, Patent Owner's proffered sales data is weak because those patents precluded others from entering the relevant market.

c. *Long-felt Need*

As discussed above, we find an insufficient nexus between the proffered evidence and the merits of the claimed invention. Accordingly, even if Patent Owner presented persuasive evidence of long-felt need, the required nexus would still be lacking. Nevertheless, we discuss Patent Owner's evidence relating to long-felt need.

"Evidence of a long felt but unsolved need that is met by the claimed invention is further objective evidence of non-obviousness." *Millennium Pharms., Inc. v. Sandoz Inc.*, 862 F.3d 1356, 1369 (Fed. Cir. 2017). Establishing long-felt need first requires objective evidence that a recognized problem existed in the art for a long period without solution. *See Orthopedic Equip. Co., Inc. v. All Orthopedic Appliances, Inc.*, 707 F.2d 1376 (Fed. Cir. 1983); *In re Gershon*, 372 F.2d 535, 539 (CCPA 1967). Second, another must not have satisfied the long-felt need before the invention of the challenged patent. *Newell Cos. v. Kenney Mfg. Co.*, 864 F.2d 757, 768 (Fed. Cir. 1988). Third, the invention of the challenged patent must satisfy the long-felt need. *In re Cavanagh*, 436 F.2d 491, 496 (CCPA 1971); *see also Perfect Web Techs., Inc. v. InfoUSA, Inc.*, 587 F.3d 1324, 1332–33 (Fed. Cir. 2009) (articulating all three factors).

Patent Owner asserts the FEP 9494 "filled a long-felt need in the industry and received tremendous industry praise," because it "significantly reduced plate out, could be extruded at high speeds with fewer faults, and processed consistently from start to finish of the extrusion process and from lot to lot." PO Resp. 37 (citing Ex. 2008 ¶¶ 3–5, 7, 10, 11).

We cannot determine, from Patent Owner's presentation of the evidence, whether the recognized problem existed in the art for a long period without solution. Patent Owner makes general statements about the problems of the then-existing FEPs on the market. PO Resp. 37. These statements, however, do not persuasively establish the length of time the recognized problem existed. Patent Owner's evidence also does not establish the exact nature of the "recognized problem" solved by FEP 9494. Although the competitor's products referred to by Patent Owner allegedly had problems that "often resulted in unusable wire," it appears from the logical converse that those products sometimes resulted in usable wire. *Id.* Accordingly, although Patent Owner's FEP 9494 may have been a better product, it is not clear that it solved a recognized problem that existed without solution.

In a similar vein, because Patent Owner admits "a number of FEPs for use in plenum-rated cables were on the market at the time," (*id.*) it is unclear that Patent Owner establishes that "another must not have satisfied the long-felt need before the invention of the challenged patent." *Newell*, 864 F.2d at 768. Patent Owner asserts that FEP 9494 possessed properties superior to those of the existing products on the market, but this assertion does not answer the question of whether the long-felt need was not satisfied by the existing products. Again, Patent

Owner's evidence does not establish that the existing FEPs could not be extruded at high speeds while still producing a high quality wire coating.

d. Industry Praise

As discussed above, we find an insufficient nexus between the proffered evidence and the merits of the claimed invention. Accordingly, even if Patent Owner presented persuasive evidence of industry praise, the required nexus would still be lacking. Notwithstanding this deficiency, we discuss Patent Owner's evidence relating to industry praise.

Industry praise for an invention may provide evidence of non-obviousness where the industry praise is linked to the claimed invention. *See Geo. M. Martin Co. v. Alliance Mach. Sys. Int'l LLC*, 618 F.3d 1294, 1305 (Fed. Cir. 2010); *Asyst Techs. Inc., v. Emtrak, Inc.*, 544 F.3d 1310, 1316 (Fed. Cir. 2008).

Patent Owner points to one customer's enthusiasm for FEP 9494 and that customer's 18-month exclusivity agreement, assertedly because FEP 9494 was perceived by that customer to be "the best product on the market because of its superior processing and coating properties." PO Resp. 38 (citing Ex. 2008 ¶ 11). Petitioner disagrees with Patent Owner's characterization of the customer enthusiasm for the FEP 9494 product. Reply 22–24.

On this record, Patent Owner's evidence of industry praise is entitled to minimal weight. Although there is some evidence describing the enthusiasm of one customer for FEP 9494, this sole customer's enthusiasm is not shown to be reflective of the industry's opinion as a whole, and thus, we agree with

Petitioner that much of Patent Owner's evidence is of little probative value.

III. MOTION TO EXCLUDE

Petitioner moves to exclude (1) Exhibit 2040 (a Chemours brochure) as untimely non-testimonial evidence; (2) Section IV(c) of Patent Owner's Sur-Reply as waived because the arguments therein were omitted from the Response; and (3) Section III of Patent Owner's Sur-Reply as waived because the arguments therein were not addressed in the Response. Paper 50, 1–7. Patent Owner filed a Response. Paper 52. Petitioner filed a Reply. Paper 54.

Regarding the exhibit and portions of the Sur-Reply sought to be excluded, we do not affirmatively rely upon Exhibit 2040 in our present determination, nor do we need to rely on the identified Patent Owner arguments in Section IV(c) or Section III of its Sur-Reply. Therefore, we need not decide Patent Owner's Motion to Exclude, and we dismiss the motion and request as moot.

We note that Petitioner styles its motion as a "Motion to Exclude and Strike." Paper 50, 1. Petitioner notes: "To preserve their objections and arguments, Petitioners hereby move to strike and exclude the improper evidence and argument." *Id.* at 1 n.1. We have addressed the portion of Petitioner's combined motion directed to excluding evidence and portions of papers before us, and have determined to dismiss Petitioner's motion as moot. Accordingly, we need not reach the portion of Petitioner's combined motion directed to striking the same, even if such a portion of the motion were properly presented.

Accordingly, the Motion to Exclude is *dismissed*.

IV. MOTIONS TO SEAL

Patent Owner and Petitioner each filed three separate Motions to Seal portions of certain papers and exhibits. Papers 20, 42, 47 (Patent Owner); Papers 28, 38, 57 (Petitioner).

In its first Motion to Seal, Patent Owner seeks to seal the confidential versions of Exhibits 2007, 2009, 2021, 2022, 2029–2032, 2034, 2036, which are the Declarations of John Hansen and Gregory Chapman, and documents containing financial and other proprietary information relied upon by Patent Owner in making its secondary considerations case. Paper 20, 1–4. Patent Owner represents that the parties agreed to a modified version of the Board's Default Protective Order, and submits a Proposed Protective Order as Appendix A. *Id.* at 5. In its second Motion to Seal, Patent Owner seeks to seal its Patent Owner Response to Petitioner's Motion for Routine and Additional Discovery (Paper 34). Paper 42, 1. Patent Owner submitted both a public and a confidential version of this document. Papers 34, 43. In its third Motion to Seal, Patent Owner seeks to seal Exhibit 2039. Paper 47, 1. Patent Owner represents that good cause exists because this document references Exhibit 1040, also sought to be placed under seal. *Id.* at 2.

In its first Motion to Seal, Petitioner seeks to seal Petitioner's Motion for Routine and Additional Discovery from Patent Owner (Paper 29). Paper 28, 1. Petitioner submits that good cause exists to seal this paper to the extent it references or incorporates information from Exhibits 2021, 2029, and 2032. *Id.* at 2. In its second Motion to Seal, Petitioner seeks to seal Petitioner's Reply (Paper 40), and Exhibits 1040, 1041, and 1043. Paper 38, 1. Petitioner represents that the Reply and other exhibits sought to be sealed reference information that Patent Owner has designated as confidential. *Id.* at 2. Petitioner submitted both a public and a confidential version of its Reply. Papers 39, 40. In its third Motion to Seal, Petitioner seeks to seal Petitioner's demonstrative exhibits, filed as Exhibit 1062. Paper 57. Regarding Petitioner's third Motion to Seal, the Board, pursuant to a call with the parties, expunged the version of the demonstrative exhibits containing confidential information, and required Petitioner to file a version of the demonstrative exhibits that contained no confidential information. Ex. 1063, 21:20–24, 26:14–17. Petitioner filed such a version of its demonstrative exhibits (also designated Exhibit 1062) and, thus, Petitioner's third Motion to Seal is dismissed as moot.

"There is a strong public policy for making all information filed in a quasi-judicial administrative proceeding open to the public, especially in an *inter partes* review which determines the patentability of claims in an issued patent and therefore affects the rights of the public." *Garmin Int'l v. Cuozzo Speed Techs., LLC*, IPR2012-00001, Paper 34, 1–2 (PTAB Mar. 14, 2013). For this reason, except as otherwise ordered, the record of an *inter partes* review trial shall be made available to the public. *See* 35 U.S.C. § 316(a)(1); 37 C.F.R. § 42.14. The standard for granting a motion to seal is good cause. 37 C.F.R. § 42.54. That standard includes showing that the information addressed in the motion to seal is truly confidential, and that such confidentiality outweighs the strong public interest in having the record open to the public. *See Garmin*, slip op. at 2–3.

After having considered the arguments, we determine that the parties establish good cause for sealing the documents identified in the respective Motions. Specifically, the parties demonstrate that the information they seek to seal consists of exhibits and testimony dealing with confidential financial information and proprietary information regarding products germane to this proceeding, and papers that rely on the exhibits and testimony sought to be sealed. Accordingly, the Motions (Papers 20, 28, 38, 42, and 47) are *granted* and the Proposed Protective Order (Paper 20, Appendix A) is *entered.* As discussed above, however, Petitioner's third Motion to Seal (Paper 57) is *dismissed* as moot.

There is an expectation that information will be made public where the information is identified in a final written decision, and that confidential information that is subject to a protective order ordinarily would become public 45 days after final judgment in a trial, unless a motion to expunge is granted. 37 C.F.R. § 42.56; Office Patent Trial Practice Guide, 77 Fed. Reg. 48,756, 48,761 (Aug. 14, 2012). A party who is dissatisfied with the Final Decision may appeal the Decision pursuant to 35 U.S.C. § 141(c), and has 63 days after the date of the Decision to file a notice of appeal. 37 C.F.R. § 90.3(a). Thus, it remains necessary to maintain the record, as is, until resolution of an appeal, if any. In view of the foregoing, the confidential documents filed in the instant proceeding will remain under seal, at least until the time period for filing a notice of appeal has expired or, if an appeal is taken, the appeal process has concluded. The record for the instant proceeding will be preserved in its entirety, and the confidential documents will not be expunged or made public, pending appeal. Notwithstanding 37 C.F.R. § 42.56 and the Office Patent Trial Practice Guide, neither a motion to expunge confidential documents nor a motion to maintain these documents under seal is necessary or authorized at this time. *See* 37 C.F.R. § 42.5(b).

V. CONCLUSION[19]

We conclude that Petitioner has satisfied its burden of demonstrating, by a preponderance of the evidence, that the subject matter of claims 3 and 4 of the ’431 patent is unpatentable.

VI. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner establishes, by a preponderance of the evidence, that claims 3 and 4 of U.S. Patent No. 8,076,431 B2 are unpatentable;

FURTHER ORDERED that Petitioner’s Motion to Exclude is *dismissed*;

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[19] Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner’s attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding. See* 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. § 42.8(a)(3), (b)(2).

FURTHER ORDERED that the parties' Motions to Seal (Papers 20, 28, 38, 42, and 47) are *granted* and the Proposed Protective Order (Paper 20, Appendix A) *entered*, but that Petitioner's third Motion to Seal (Paper 57) is *dismissed* as moot; and

FURTHER ORDERED that this is a Final Written Decision; therefore, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

In summary:

Claims	**35 U.S.C. §**	**Reference(s)**	**Claims Shown Unpatentable**	**Claims Not shown Unpatentable**
3, 4	103	Hiraga, Kaulbach		3, 4
3, 4	103	Hiraga		3, 4
3, 4	102/103	Kono		3, 4
3, 4	103	Kono		3, 4
3, 4	103	Kaulbach	3, 4	
Overall Outcome			**3, 4**	

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APPENDIX E

Trials@uspto.gov   Paper No. 8
571-272-7822   Entered: November 13, 2018

UNITED STATES PATENT AND
TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND
APPEAL BOARD

DAIKIN INDUSTRIES LTD. and DAIKIN
AMERICA, INC.,
Petitioner,

v.

THE CHEMOURS COMPANY FC, LLC,
Patent Owner.

IPR2018-00992
Patent 7,122,609 B2

Before JO-ANNE M. KOKOSKI, KRISTINA M. KALAN, and SHELDON M. McGEE, *Administrative Patent Judges.*

KALAN, *Administrative Patent Judge.*

DECISION
Institution of *Inter Partes* Review
35 U.S. §314(a)

I. INTRODUCTION

A. Background

Daikin Industries Ltd. and Daikin America, Inc. (collectively, "Petitioner") filed a Petition requesting an inter partes review of claims 1–7 of U.S. Patent No. 7,122,609 B2 (Ex. 1001, "the '609 patent"). Paper 1 ("Pet."). The Chemours Company FC, LLC ("Patent Owner") filed a Preliminary Response to the Petition. Paper 7 ("Prelim. Resp.").

We have jurisdiction under 35 U.S.C. § 314, which provides that an *inter partes* review may not be instituted "unless . . . there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." 35 U.S.C. § 314(a). Upon consideration of the Petition and the Preliminary Response, and the evidence of record, we determine that Petitioner has shown a reasonable likelihood that it would prevail in showing the unpatentability of at least one of claims 1–7. Accordingly, we institute an *inter partes* review of claims 1–7 of the '609 patent.

B. Related Proceedings

The parties identify the following district court proceeding as related to the '609 patent: *Chemours Company FC, LLC* v. *Daikin Industries, Ltd.*, Civil Action No. 1:17-cv-01612-GMS (D. Del.). Pet. 62; Paper 4, 2.

C. The '609 Patent (Ex. 1001)

The '609 patent, titled "High Melt Flow Fluoropolymer," issued on October 17, 2006. Ex. 1001, at [54], [45]. The '609 patent relates to a partially-crystalline copolymer of tetrafluoroethylene ("TFE") and hexafluoropropylene (“HFP”) in an amount corresponding to particular hexafluoropropylene index (“HFPI”), and about 0.2% to 3% by weight of perfluoro(alkyl vinyl ether). *Id.* at [57]. Such copolymers, also known as fluorinated ethylene-propylene or “FEP” copolymers, “can be extruded at high speed onto conductor over a broad polymer melt temperature range to give insulated wire of high quality.” *Id.* at 1:59–61.

D: Challenged Claims

Claim 1 is the only independent claim of the ’609 patent. Claims 2–7 depend directly or indirectly from claim 1. Claim 1 is reproduced below:

> 1. A partially-crystalline copolymer comprising tetrafluoroethylene, hexafluoropropylene in an amount corresponding to a hexafluoropropylene index (HFPI) of from about 2.8 to 5.3, said copolymer being polymerized and isolated in the absence of added alkali metal salt, having a melt flow rate of within the range of about 30±3 g/10 min, and having no more than about 50 unstable endgroups/106 carbon atoms.

Ex. 1001, 10:15–21.

G. The Asserted Grounds of Unpatentability

Reference(s)	**Basis**	**Claims Challenged**
Hiraga[1]	§ 102(a)	1-7
Hiraga and/or Hiraga and Kaulbach[2]	§ 103(a)	1-7
Kono[3]	§ 102(e)(2) and/or § 103(a)	1-7
Kono	§ 103(a)	1-7
Kaulbach	§ 103(a)	1-7

II. ANALYSIS

A. Claim Construction

In an inter partes review, claim terms in an unexpired patent are interpreted according to their broadest reasonable constructions in light of the Specification of the patent in which they appear. See 37 C.F.R. § 42.100(b); *Cuozzo Speed Techs., LLC* v. *Lee*, 136 S. Ct. 2131, 2142 (2016).[4] Under the broadest

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[1] JP 2002-249585, published September 6, 2002 (as translated) (Ex. 1025).

[2] U.S. Pat. No. 6,541,588 B1, issued April 1, 2003 (Ex. 1009).

[3] U.S. Pat. No. 6,743,508 B2, issued June 1, 2004 (Ex. 1008).

[4] The revised claim construction standard for interpreting claims in *inter partes* review proceedings as set forth in the final rule published October 11, 2018 does not apply to this proceeding, because the new "rule is effective on November 13, 2018 and applies to all IPR, PGR and CBM petitions filed on or after the effective date." Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial

reasonable construction standard, claim terms are presumed to have their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Only terms that are in controversy need to be construed, and then only to the extent necessary to resolve the controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

Petitioner offers proposed constructions for a number of recited limitations, namely, "polymerized and isolated," "about 30±3 g/10 min" and "about 50 unstable endgroups." Pet. 16–24. The latter construction concerns the phrase "unstable endgroup." *Id.* at 23. Petitioner notes that although the '609 patent exemplifies four unstable endgroups ($–CONH_2$, $–CF_2CH_2OH$, –COF, and –COOH), "other unstable endgroups are also possible," such as ethyl endgroups. *Id.* at 24 (citing Ex. 1002, ¶¶ 92–93). Thus, Petitioner urges that the broadest reasonable construction of the term "unstable endgroup" includes such "endgroups resulting from any FEP polymerization process" and not only those species exemplified in the '609 patent. *Id.* Patent Owner accepts Petitioner's proposed claim construction for the term "unstable endgroups." Prelim. Resp. 10 n.1.

For purposes of this Decision, we construe the term "unstable endgroups" to include not only those unstable endgroups exemplified in the '609 patent, but "[all] unstable endgroups resulting from any FEP polymerization process" as agreed to by the parties.

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and Appeal Board, 83 Fed. Reg. 51340 (Oct. 11, 2018) (to be codified at 37 C.F.R. pt. 42).

Based on the record before us, we determine that no other claim terms require an explicit construction at this time.

B. Prior Art

i. Hiraga (Ex. 1025)

Hiraga discloses methods of modifying a fluoropolymer via a melt-kneading process. Ex. 1025, at [57]. Hiraga discloses that the modification method efficiently stabilizes unstable groups contained on the melt-processable fluoropolymer, homogenizes and prevents a decrease in the fluoropolymer's molecular weight, and increases the fluoropolymer's processability, thus enabling the production of "a molded article free of air bubbles and coloration." *Id.* ¶ 11.

Hiraga's method "may be applied to any melt-processable fluorine-containing polymer having unstable groups, but is particularly effective as a stabilization treatment for the unstable groups of" copolymers containing "tetrafluoroethylene (TFE) [and] hexafluoropropylene (HFP)," also known as "FEP" polymers. *Id.* ¶¶ 19, 26. According to Hiraga, unstable groups include vinyl end groups ($–CF=CF_2$) and acid fluoride end groups ($–COF$), and may cause bubbles and cavities to form in the final product. *Id.* ¶ 3.

To achieve "the most homogeneous molecular weight possible, and not simply stabilize the unstable groups," Hiraga teaches that it is important "that water is not present" during the first step, i.e., "step (A)," "in which the treatment with oxygen-containing gas is carried out." *Id.* ¶ 30. Because the fluoropolymer's unstable groups cannot be stabilized in the presence of oxygen alone, however, it "is melt-kneaded in the presence of oxygen while further aggressively introducing water, thereby both stabilizing the unstable groups and also oxidizing to remove coloration substances (step (B))." *Id.* ¶ 41. Hiraga discloses that a reaction accelerator may be added before or during either step A or B, and that such reaction accelerators may be a compound containing an alkaline metal, an alkaline earth metal, an ammonium salt, ammonia, an alcohol, an amine, or a salt thereof. *Id.* ¶¶ 48–49.

Hiraga discloses Comparative Example 1 ("Example 1C") wherein a modified FEP polymer containing 15 ppm potassium was processed to yield a FEP copolymer with a melt flow rate of 30.0 g/10 min, and zero unstable groups per 106 carbons. *Id.* ¶¶ 107, 114–117.

ii. Kaulbach (Ex. 1009)

Kaulbach discloses "melt-processable tetrafluoroethylene TFE)/hexafluoropropylene (HFP) copolymer melt pellets having an improved processability for wire and cable application and to a method of using this polymer to coat wire and cable conductors." Ex. 1009, 1:9–13. Kaulbach teaches that metal contaminants in the copolymer may cause it to degrade or decompose at high processing temperatures, which may in turn cause discoloration and "a build up of die drools." *Id.* at 2:4–8. According to Kaulbach, "[d]ie drools are accumulations of molecular fractions of the polymer at the surface of the die exit" and "impair the coating processing." *Id.* at 2:8–10. To assist with this and other potential problems, Kaulbach instructs that the copolymer "should be made more thermally stable not only by eliminating the thermally unstable endgroups but also by avoiding metal contaminants." *Id.* at 2:27–29. Kaulbach discloses that a "preferred version of the polymerization recipe here is an alkali metal salt-free recipe." *Id.* at 4:44–45.

iii. Kono (Ex. 1008)

Kono discloses pellets that comprise "a copolymer obtained by copolymerizing monomer components containing tetrafluoroethylene (TFE) and hexafluoropropylene (HFP)," also known as a "FEP pellet." Ex. 1008, 3:32–36. Kono discloses that the inventive FEP pellet is used in a coating extrusion process for insulating a core wire, i.e., by melting the FEP pellet "by heating within an extruder for coating a core wire and extruded from a die, and then drawn down by coating the core wire to thereby form an insulated cable." *Id.* at 4:29–34.

Kono discloses that the extrusion process with the inventive FEP pellet can be carried out at a speed of 2800 ft/min when the adhesive strength between the insulating material and the core wire is 0.8 kg or more. *Id.* at 4:42–50. Kono hypothesizes that the "excellent adhesive strength" exhibited by the inventive FEP pellets when extruded may be due to the presence of a certain functional group, also known as an "adhesion factor" or, if the adhesion factor is located at end of the polymer, as an "adhesion terminus." *Id.* at 5:1–9. Kono teaches that the functional group is "not particularly limited as long as it contributes to enhanced adhesion with the core wire at high temperature, and includes, for example, a functional group which is generally known to be unstable at high temperature." *Id.* at 5:14–18. Kono identifies several such known functional groups, including–COOM, $-SO_3M$, $-OSO_3M$, $-SO_2F$, $-SO_2Cl$, –COF, $-CH_2OH$, $-CONH_2$, and $-CF{=}CF_2$, where M is selected from an alkyl group, a hydrogen atom, a metallic cation and a quaternary ammonium cation. *Id.* at 5:18–22.

Kono discloses that the number of functional groups located at the terminal portion of the polymer depends on a number of factors, including the polymer's melt flow rate and the monomers present therein. *Id.* at 5:23–27. Kono also discloses example pelletized FEP powders where, inter alia, the number of certain functional groups (i.e., "adhesion terminus" groups) per 106 carbon atoms were measured. *Id.* at 12:11–16:47. The "adhesion terminus" groups measured for Kono's Examples 1–7 and Kono's Comparative Examples 1–5 were limited to –COF, –COOH, and $-CH_2OH$. *Id.* at 15:1–18:20.

C. Asserted Anticipated Based on Hiraga (Ground 1)

Petitioner assets that claims 1–7 are unpatentable as anticipated under 35 U.S.C. § 102(a) in view of Hiraga. Pet. 25–35. Petitioner asserts that Hiraga "discloses FEP-copolymers that anticipate the challenged claims." *Id.* at 25. Petitioner provides a detailed explanation alleging where each limitation of the claims can be found in Hiraga. *Id.* at 26–35 (citing Ex. 1002 ¶¶ 110–147).

Patent Owner challenges Petitioner's position that claims 1–7 are anticipated by Hiraga. Prelim. Resp. 10–16. Specifically, Patent Owner avers that Petitioner's anticipation challenge fails because "(1) Hiraga's FEP in Example 1C was not 'polymerized and isolated in the absence of alkali metal salt,' and (2)

[Petitioner] fails to show that Hiraga's FEP necessarily has no more than 'about 50 unstable endgroups' per million carbon atoms." *Id.* at 10.

Regarding Patent Owner's first argument, we note that claim 1 requires a FEP "polymerized and isolated in the absence of added alkali metal salt." Ex. 1001, 10:19–20. Patent Owner argues that a clear reading of Hiraga's Example 1C is that "the FEP includes 15 ppm potassium before any endgroup stabilization—meaning that it was added either during polymerization or isolation." Prelim. Resp. 12. Patent Owner also points out Hiraga's disclosure that an alkali metal can be added to the FEP "in advance" of any finishing steps as a reaction accelerator. *Id.* (citing Ex. 1025 ¶¶ 17, 48, 49). We agree that Petitioner has not demonstrated, on this record, that the FEP in Hiraga is polymerized and isolated in the absence of added alkali metal salt, because the presence of 15 ppm potassium and the reaction accelerator conditions described in Hiraga indicate that the polymerization and isolation may take place in the presence of an alkali metal.

Patent Owner's second argument, using Petitioner's construction of the limitation "unstable endgroup," posits that the "FEP disclosed in Hiraga's examples does not necessarily have fewer than about 50 unstable endgroups per million carbon atoms." Prelim. Resp. 13. According to Patent Owner, Hiraga's disclosure of "zero" unstable endgroups per million (i.e., 10^6) carbon atoms "does not identify the types of unstable endgroups that are measured." *Id.* at 14. More particularly, it does not include endgroups other than –COOH, and –COF. *Id.* at 13–14.

We agree with Patent Owner that, on this record, Petitioner fails to establish a reasonable likelihood that Hiraga anticipates claims 1–7 of the ’609 patent. In particular, Petitioner fails to provide sufficient evidence to establish that Hiraga discloses a FEP polymer with the recited number of unstable endgroups, i.e., “no more than about 50 unstable endgroups/106 carbon atoms.” We begin with Petitioner’s claim construction of the term “unstable endgroups” (Pet. 23–24), which we adopted for purposes of this Decision, namely, that the term “unstable endgroups” includes not only those unstable endgroups exemplified in the ’609 patent, but “all unstable endgroups resulting from any FEP polymerization process.” Such unstable endgroups include ethyl groups ($–CF_2CH_2CH_3$). Ex. 1002 ¶ 93; Ex. 1035 ¶ 2.6; *see also* Ex. 1008, 5:14–22 (reciting various known terminal functional groups that are “unstable at high temperature”); Ex. 1010, 5:38–39 (“[t]he presence of methanol can also lead to methyl ester ends ($-CO_2CH_3$)”); Ex. 1025 ¶¶ 3, 34, 44 (identifying a vinyl group ($–CF=CF_2$) along with carboxylic acid ($–COOH$) and acid fluoride ($–COF$) groups as unstable groups).

Petitioner also cites to Hiraga’s disclosure that the copolymer (Table 1, row 3) had 0 unstable endgroups per 106 carbons. Pet. 31. However, as noted by Patent Owner, this range is specific to only two endgroups, and does not address other endgroups such as $–CONH_2$ or alkyl ester endgroups (such as methyl ester groups). Prelim. Resp. 15–16. Petitioner’s reliance on Hiraga’s disclosure of 0 unstable endgroups of $-COOH$ and $–COF$ groups per million carbon atoms is insufficient to establish that Hiraga discloses "no more than about 50" of *all* possible unstable endgroups resulting from any FEP polymerization process per our construction of this limitation.

For these reasons, we agree with Patent Owner that, on this record, Petitioner fails to establish a reasonable likelihood that Hiraga anticipates claims 1–7.

D. Asserted Obviousness Based on Hiraga Alone (Group 2)

Petitioner asserts that Hiraga alone renders claims 1–7 of the '609 patent obvious under 35 U.S.C. § 103(a) because the skilled artisan would have found it obvious to substitute Hiraga's melt-kneading process with an alternative fluorination process, "or to use melt-kneading only to adjust the [melt flow rate] of the copolymer and separately remove unstable endgroups using fluorination." Pet. 37 (citing Ex. 1002 ¶¶ 154–157). Petitioner asserts that the skilled artisan would have been motivated to use such a fluorination process in Hiraga "for many reasons," including because the skilled artisan would have understood that fluorination is "an alkali-metal-free stabilization method," and also "provides benefits compared to other stabilization techniques, such as Hiraga's wet-heat treatment." *Id.* at 37–38 (citing Ex. 1002 ¶ 155–156). Petitioner points to evidence that purportedly demonstrates fluoropolymers containing endgroups that are stabilized via a fluorination process have "better electrical properties than those untreated or treated using different means." *Id.* at 38 (citing Ex. 1027, 3:34–39).

Patent Owner challenges Petitioner's assertion that it would have been obvious to modify Hiraga's process in the manner proposed. Prelim. Resp. 16–20. Specifically, Patent Owner notes Hiraga's emphasis on a two-step melt-kneading process, describing it as "the present invention," and that the proffered substitution "would eviscerate [Hiraga's] core invention." *Id.* at 19. Patent Owner also questions how fluorination would achieve Hiraga's stated objective (Ex. 1025 ¶ 30) to "create a polymer with the most homogeneous molecular weight possible, and not simply stabilize the unstable groups," because Petitioner failed to provide evidence to demonstrate "that fluorination has any impact on molecular weight." Prelim. Resp. 20. Patent Owner also contends that Hiraga does not recognize the need for minimizing alkali metal salt concentration, because it teaches such salts as polymerization initiators and reaction accelerators. *Id.* at 17. Additionally, Patent Owner avers that "Hiraga does not appreciate the importance of the claimed high" melt flow rate ("MFR") range, because Comparative Example 1 achieved melt flow rates of 30 and 38.1 g/10 min which each fall outside a target range "of between 22.5 to 28.0 g/10 min." *Id.* at 18.

For several reasons, we do not agree that Petitioner has established a reasonable likelihood that claims 1–7 are obvious based on the disclosure of Hiraga alone. As noted by Patent Owner (Prelim. Resp. 20), Hiraga is not only focused on stabilizing unstable endgroups of fluoropolymers, but also seeks to tailor the fluoropolymer's molecular weight in order to "create a polymer with the most homogeneous molecular weight possible." Ex. 1025 ¶ 30. Petitioner fails to explain how, or provide evidentiary support to reasonably establish that, substituting both steps of Hiraga's two-step melt-kneading process with a fluorination process would have any impact on a fluoropolymer's molecular weight. We note Petitioner's recognition that a polymer's molecular weight is inversely related to its melt flow rate. Pet. 9 (citing Ex. 1009, 6:33–35; Ex. 1006, 3:21–27; Ex. 1002 ¶ 50). Thus, it is unclear what impact, if any, a fluorination process would have on the melt flow rate of the polymer disclosed in Hiraga's Comparative Example 1—i.e., the polymer that Petitioner relies on in its obviousness challenge. Pet. 37–38. We emphasize that, prior to melt-kneading, Comparative Example 1 has a melt flow rate of 25 g/10 min, which is outside the claimed range of "about 30±3 g/10 min." Ex. 1025 ¶¶ 107, 114, 117. Only after melt-kneading does the polymer exhibit a melt flow rate falling within the recited range. Although Petitioner urges that it likewise would have been obvious to modify the fluoropolymer's molecular weight by melt-kneading "and separately remove unstable endgroups using fluorination," Petitioner does not sufficiently explain why the skilled artisan would do so. Pet. 37–38.

We, therefore, are not persuaded that Petitioner has established a reasonable likelihood of establishing that claims 1–7 are unpatentable as obvious over the disclosure of Hiraga alone.

E. Asserted Obviousness Based on Hiraga and Kaulbach (Group 2)

Petitioner asserts that claims 1–7 of the '609 patent are unpatentable as obvious under 35 U.S.C. § 103(a) over Hiraga in view of Kaulbach. Pet. 35–38.

In asserting that claims 1–7 are unpatentable as being obvious over the combined disclosures of Hiraga and Kaulbach, Petitioner specifically points to Hiraga's Comparative Example 1, which "employs melt-kneading to remove unstable endgroups from a fluoropolymer that was blended with an alkali metal after polymerization and isolation." *Id.* at 35–36. Petitioner then turns to Kaulbach's disclosure regarding certain benefits that may be realized by avoiding metal contamination, specifically alkali metal contamination, when processing melt-processable FEP. *Id.* at 36.

Petitioner asserts that the skilled artisan, armed with the teachings of Kaulbach, "would have been motivated to avoid using alkali metals in Hiraga's Comparative Example 1, and would have employed one of the other reaction accelerators Hiraga discloses." *Id.* at 36. Petitioner urges that "[d]oing so would result in a final copolymer made without the addition of alkali metal salt," thus rendering claims 1–7 obvious. *Id.*

Petitioner asserts further that the disclosures of Hiraga and Kaulbach are properly combinable because the references are "directed to the same technology and seek to obtain the same benefits," and also focus on preparing "copolymers of high MFR that are stabilized to remove unstable endgroups." *Id.* at 36. As such, the skilled artisan, upon considering Hiraga's examples, "would have logically looked to Kaulbach for ways to further improve the melt-processability of the copolymer," and would have reasonably expected "improved processability and low incidences of flaws" in a FEP copolymer by avoiding metal contamination therein as taught by Kaulbach.

Id. at 37. Alternatively, Petitioner argues that it would have been obvious to one of ordinary skill in the art to use fluorination in place of Hiraga's melt-kneading process, because fluorination is an alkali-metal-free stabilization method, and because fluorination provides benefits compared to other stabilization techniques. *Id.* at 37–38.

Patent Owner first argues that Hiraga "does not appreciate the importance of eliminating or reducing alkali metal ions." Prelim. Resp. 17. Patent Owner points to Hiraga's use of alkali metal salts as polymerization initiators and reaction accelerators, and argues that Kaulbach "is primarily concerned with non-alkali metals—such as iron, chromium, and nickel—and teaches that such metals can lead to polymer decomposition." *Id.* Patent Owner alleges that Petitioner "relies on one lone sentence in Kaulbach stating that alkali metal salt-free recipes are preferred," but that Kaulbach fails to explain why there is such a preference, and allows for alkali metal salts such as potassium and sodium to be used. *Id.* Patent Owner thus urges that "taken as a whole, Kaulbach does not appreciate the criticality of avoiding all alkali metal salts." *Id.*

Based on this preliminary record, we disagree with Patent Owner. We note that Petitioner does not solely rely on "one lone sentence" within Kaulbach to support its argument as Patent Owner contends. Prelim. Resp. 17. Rather, Petitioner identifies four passages in Kaulbach. Pet. 36 (citing Ex. 1009, 2:4–11, 2:27–31, 4:45–46, and 5:14–17). Kaulbach's disclosure as identified by Petitioner goes beyond merely discouraging the presence of alkali metals in FEP polymers, but rather instructs to avoid "metal contaminants" generally in such polymers. *See* Ex. 1009, 2:4–6, 27–31 (explaining that metal contamination should be avoided because "[m]etal contaminants are difficult to cope with" and "may result in degradation and decomposition of the copolymer at high processing temperatures" leading to problems with the coating process such as die drool); *see also id.* at 4:19–20 (identifying metal contaminants such as iron, nickel, and chromium "in particular," but not limiting metal contaminants to only these three species). Because Kaulbach discusses specific problems known to occur when processing FEP polymers that contain metal contaminants generally, i.e., metal contamination not necessarily limited to alkali metal salts, we decline to read Kaulbach's disclosure as narrowly as Patent Owner urges.

Furthermore, we are not persuaded by Patent Owner's argument that because Kaulbach "teaches that potassium persulfate and sodium bicarbonate may be used" in the same paragraph in which Kaulbach discloses a preference for "alkali metal salt-free recipes," Kaulbach does not appreciate why alkali metal salts should be minimized. Prelim. Resp. 17 (citing Ex. 1009, 4:28–34, 4:44–45). Here, Kaulbach teaches that an initiator such as ammonium or potassium persulfate may be used in the polymerization reaction. Ex. 1009, 4:27–30. Kaulbach further discloses that buffers such as ammonia, ammonium carbonate, and sodium bicarbonate "can be incorporated in the recipe." *Id.* at 4:32–33. Kaulbach does not state, however, that such initiators or buffers are required components of the polymerization reaction, but instead indicates that they "may be" or "can be" used. *Id.* at 4:27–30, 4:32–

33. Also, should an initiator and/or buffer be used, Kaulbach provides alkali-metal free options from which to choose. *Id.* Thus, Kaulbach's teaching that potassium persulfate and sodium bicarbonate may be used does not negate Kaulbach's overall teaching that metal contaminants are problematic and should be avoided. *See In re Fritch*, 972 F.2d 1260, 1264 (Fed. Cir. 1992) ("It is well settled that a prior art reference is relevant for all that it teaches to those of ordinary skill in the art.").

For these reasons, based on the record currently before us, we conclude that Petitioner has demonstrated a reasonable likelihood that it would prevail in showing that claims 1–7 are unpatentable as being obvious over Hiraga and Kaulbach.

F. Asserted Anticipation Based on Kono (Ground 3)

Petitioner asserts that claims 1–7 of the '609 patent are anticipated by Kono. Pet. 38–50. [5] Petitioner argues that Kono discloses "copolymers meeting each of the relevant claim limitations." Pet. 39. Petitioner provides a detailed explanation alleging where each limitation can be found in Kono for these claims. *Id.* at 40–50 (citing Ex. 1002 ¶¶159–197).

Patent Owner challenges Petitioner's position that claims 1–7 are anticipated by Kono. Prelim. Resp. 20–26. Specifically, Patent Owner avers that Petitioner's anticipation challenge fails because Kono does not disclose a FEP polymer "that has no more than about

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[5] Petitioner appears to argue that only claims 1–5 and 7 are anticipated by Kono, and that claim 6 is only rendered obvious by Kono. Pet. 40 ("Kono anticipates claims 1–5, and 7"); *id.* at 50 ("Kono renders obvious claim 6").

50 unstable endgroups per million carbon atoms." *Id.* at 20. According to Patent Owner, using Petitioner's construction of the limitation "unstable endgroup," there is "no evidence demonstrating that Kono's FEPs necessarily lack any other unstable endgroups" beyond those measured, i.e., –COOH, –COF, and –CH_2OH. *Id.* at 20–21. According to Patent Owner, Kono's disclosure of 15–150 unstable endgroups per million (i.e., 10^6) carbon atoms does not include endgroups other than –COOH, –COF, and –CH_2OH. *Id.* at 22. Further, Patent Owner contends that Kono's broad range of 15–150 for the –COOH, –COF, and –CH_2OH endgroups does not anticipate the claimed range of "no more than about 50 unstable endgroups/10^6 carbon atoms," which may include unstable endgroups other than those disclosed in Kono, such as –$CONH_2$ groups, methyl ester groups, and vinyl groups. *Id.* (citing Ex. 1008, 5:27–33).

We agree with Patent Owner that, on this record, Petitioner fails to establish a reasonable likelihood that Kono anticipates claims 1–7 of the '609 patent. In particular, Petitioner fails to provide sufficient evidence to establish that Kono discloses a FEP polymer with the recited number of unstable endgroups, i.e., "no more than about 50 unstable endgroups/106 carbon atoms." We begin with Petitioner's claim construction of the term "unstable endgroups" (Pet. 20), which we adopted for purposes of this Decision, namely, that the term "unstable endgroups" includes not only those unstable endgroups exemplified in the '609 patent, but "all unstable endgroups resulting from any FEP polymerization process." Such unstable endgroups include ethyl groups (–$CF_2CH_2CH_3$). Ex. 1002 ¶ 93;

Ex. 1035 ¶ 2.6; see also Ex. 1008, 5:14–22 (reciting various known terminal functional groups that are "unstable at high temperature"); Ex. 1010, 5:38–39 ("[t]he presence of methanol can also lead to methyl ester ends ($–CO_2CH_3$)"); Ex. 1025 ¶¶ 3, 34, 44 (identifying a vinyl group ($–CF=CF_2$) along with carboxylic acid (–COOH) and acid fluoride (–COF) groups as unstable groups).

Petitioner also cites to Kono's disclosure "that the total number of $-CH_2OH$, –COOH, and –COF groups should be between 15–150 per 10^6 carbon atoms." Pet. 39. However, as noted by Patent Owner, this range is specific to only three endgroups, and does not address other endgroups such as $-CONH_2$, methyl ester groups, and vinyl groups. Prelim. Resp. 20–21; Ex. 1008, 5:27–33. Simply stated, Petitioner's reliance on Kono's range of 15–150 $–CH_2OH$, –COOH, and –COF groups per million carbon atoms is insufficient to establish that Kono discloses "no more than about 50" of all possible unstable endgroups resulting from any FEP polymerization process per our construction of this limitation.

For the same reason, Petitioner's reliance on Kono's Example 2 and Comparative Example 3 falls short of establishing anticipation. Pet. 40–50. These specific embodiments only measured "the numbers of the respective groups –COF, –COOH and $–CH_2OH$." Ex. 1008, 12:57–59, Table 1. Notably, Kono does not indicate whether two of the four exemplary endgroups identified in the '609 patent are present, much less whether other possible unstable endgroups are present as well. This is particularly important here given how close the measured values already are to the claimed limit for all unstable endgroups; Kono's

Example 2 contains 58 of the measured endgroups, while Comparative Example 3 has 50 of such endgroups. We also note Patent Owner's evidence that states that methanol may lead to unstable endgroups such as carbinol (–CH_2OH) and methyl ester endgroups (–CO_2CH_3). Ex. 1010, 5:35–51.

For these reasons, we agree with Patent Owner that, on this record, Petitioner fails to establish a reasonable likelihood that Kono anticipates claims 1–7.

G. Asserted Obviousness Based on Kono (Grounds 3 and 4)

In the alternative, Petitioner asserts that claims 1–7 of the '609 patent are rendered obvious in view of Kono. Pet. 38–51. In support of its obviousness challenge, Petitioner relies on the same general disclosure of Kono as in its anticipation challenge, and additionally relies on Kono's Comparative Example 5 as well as Kono's disclosure of a fluorination process. Pet. 51 (citing Ex. 1002 ¶¶ 198–202).

Petitioner asserts that it would have been obvious for the skilled artisan to employ a fluorination process "for a reduced time or at a reduced temperature" to treat the polymers of Kono's Example 2 and Comparative Example 3 in order "to reduce the number of unstable endgroups to the minimum necessary for sufficient adhesion strength." *Id.* According to Petitioner, copolymers subjected to a fluorination process "were known to have benefits over those unstabilized or stabilized by other procedures, such as the wet-heat treatment of Kono, including better electrical properties obtained by converting –CF_2H endgroups to –CF_3 endgroups." *Id.*

Patent Owner focuses on Kono's disclosure of only a limited number of unstable endgroups for all embodiments, including Comparative Example 5. Prelim. Resp. 26–28. Patent Owner argues that it would not have been obvious to fluorinate the FEP polymers of Kono because doing so would "undermine the purpose of Kono: to produce FEP pellets with unstable endgroups so as to increase adhesive strength between the FEP and the wire." *Id.* at 26. Patent Owner asserts that Kono disparages Comparative Example 5 because it has no "reported unstable –COF, -COOH, and –CH_2OH groups." *Id.* As such, Patent Owner argues that the skilled artisan would not have been motivated to fluorinate Kono's FEP polymers, or use another terminal group stabilization treatment, and that Petitioner's allegation is "based solely on hindsight." *Id.* at 27–28.

As we explained with respect to Petitioner's anticipation challenge based on Kono, we agree that Petitioner does not establish sufficiently that Kono discloses the recited unstable endgroup limitation. *See supra* Section II.F. We also determine that Petitioner fails to identify a sufficient reason for the skilled artisan to have modified the teachings of Kono to arrive at the recited unstable endgroup range. In that regard, Kono expresses a desire to maintain unstable endgroups because these groups "contribute[] to enhanced adhesion [of the FEP] with the core wire at high temperature." Ex. 1008, 5:14–16. Kono describes Comparative Example 5, which has zero –COF and –COOH endgroups,[6] as "inferior in

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[6] We observe that Kono gives no measurement value for CH_2OH groups. Ex. 1008, 18:19.

adhesion strength" to Example 7, which has 21 –COOH groups. *Id.* at 18:36–40. Kono also states that Comparative Example 3, containing a total of 50 –COF, –COOH, and -CH_2OH endgroups, is "inferior in at least one of the evaluation criteria" such as spark-out, cone-breaks and adhesive strength between the insulating material and the core wire. *Id.* at 15:50–59.

In view of these teachings, Petitioner does not explain sufficiently why the skilled artisan would have been motivated to employ a fluorination process to minimize or eliminate unstable endgroups in Kono. Nor has Petitioner explained how the skilled artisan would even arrive at what "a sufficient number of unstable endgroups" would be in designing the proffered fluorination process. Pet. 51. Thus, we agree with Patent Owner that Petitioner's obviousness challenge based on Kono employs impermissible hindsight. Prelim. Resp. 28. For these reasons, and on this record, Petitioner fails to establish a reasonable likelihood that Kono renders obvious claims 1–7.

H. Asserted Obviousness Based on Kaulbach (Ground 5)

Petitioner asserts that claims 1–7 of the '609 patent are obvious in view of Kaulbach. Pet. 52–62 (citing Ex. 1002 ¶¶ 105–106, 203–240). Petitioner specifically relies on Sample A11 of Kaulbach and alleges that "[i]n Sample A11, Kaulbach discloses a copolymer that renders obvious each and every limitation of claims 1–7 of the '609 patent." *Id.* at 53. Petitioner sets forth a detailed explanation of how Kaulbach's Sample A11 purportedly meets or renders obvious the recited limitations. *Id.* at 53–62.

Patent Owner disagrees that it would have been obvious to adjust Sample A11's melt flow rate of 24 g/10 min[7] to be within the recited range of "about 30±3 g/10 min," and further challenges Petitioner's view that Kaulbach desires an alkali-metal free recipe. Prelim. Resp. 28–32. Patent Owner also argues that (i) Kaulbach fails "to appreciate the criticality of minimizing or eliminating alkali metals," (ii) "Kaulbach is primarily concerned with polymer decomposition from non-alkali metals—iron, chromium, and nickel," and (iii) Kaulbach "expressly teaches that potassium persulfate and sodium bicarbonate—both alkali metal salts—may be used to prepare the FEP." *Id.* at 31. These arguments are similar to the arguments made by Patent Owner that we addressed above with respect to Petitioner's challenge based on Hiraga and Kaulbach, and are unpersuasive for the same reasons. *See supra* Section II.E.

Turning now to Sample A11's melt flow rate, Petitioner contends that the skilled artisan would have been motivated to increase the melt flow rate from 24 g/10 min to be within the claimed range. Pet. 55–56. Specifically, Petitioner points to Kaulbach's general teaching[8] that the "copolymers should have an

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[7] The parties agree that Kaulbach incorrectly reports melt flow rate in units of g/min rather than in g/10 min. Pet. 55 n.12; Prelim. Resp. 29 n.3. For purposes of this Decision, we treat Kaulbach's disclosure of melt flow rate in g/min as g/10 min.

[8] The disclosure to which Petitioner refers discusses a melt flow index ("MFI") value. Ex. 1008, 1:40–41, 3:43–44. Patent Owner does not dispute that a "melt flow index" is any different than the recited "melt flow rate." Rather, Patent Owner appears to acknowledge that these terms may be used interchangeably. *See*

MFR of 15 g/10 min or higher," and that Kaulbach provides no upper limit on the melt flow rate. *Id.* at 55. Thus, Petitioner asserts that Kaulbach's range completely encompasses the claimed range. Further, Petitioner avers that "[i]t was well known at the time of the '609 patent that the higher the MFR of the FEP-copolymer, the higher the speeds at which the copolymer can be processed." *Id.* at 56 (citing Ex. 1002 ¶ 216). Thus, Petitioner contends that the skilled artisan would have found it obvious to modify Sample A11 accordingly. *Id.*

Patent Owner argues that Kaulbach suggests that a copolymer with a melt flow rate of 24 g/10 min is the preferred embodiment, and the melt flow rates for Kaulbach's sample polymers range from 20–24 g/10 min. Prelim. Resp. 30. Patent Owner also contends that the skilled artisan would not have been motivated to adjust the melt flow rate based on the knowledge in the art "that higher MFR leads to higher processing speeds and that [melt flow rates] of 30 g/10 min or greater reduce melt fracture," because Kaulbach tries to solve such issues in a different way—i.e., "through a narrow molecular weight distribution." *Id.*

For the reasons below, we agree that Petitioner has established a reasonable likelihood that claims 1–7 are obvious in view of Kaulbach.

Prelim. Resp. 30 (referring to Kaulbach's MFI as "a broad, open-ended MFR range of 15 g/10 min or higher"). For purposes of this Decision, we assume that the recited "melt flow rate" and Kaulbach's "melt flow index" are interchangeable phrases describing the same parameter.

We note that Kaulbach's disclosure of a melt flow rate of greater than or equal to 15 g/10 min[9] fully encompasses the recited range of 30±3 g/10 min. In such circumstances, the narrower range may be obvious, because "[s]electing a narrow range from *within* a somewhat broader range disclosed in a prior art reference is no less obvious than identifying a range that simply overlaps a disclosed range. In fact, when, as here, the claimed ranges are completely encompassed by the prior art, the conclusion is even more compelling than in cases of mere overlap." *In re Peterson*, 315 F.3d 1325, 1329–30 (Fed. Cir. 2003) (citation omitted). We also note that Kaulbach's disclosure is not limited to its preferred embodiments. *See Fritch*, 972 F.2d at 1264. Thus, the melt flow rate of Sample A11, i.e., 24 g/10 min, does not negate Kaulbach's general teaching that "[f]or high speed wire extrusion the [melt flow rate] of the polymer is ≥15 [g/10 min]." Ex. 1009, 3:43–44.

We also are not persuaded, on this record, by Patent Owner's argument that because Kaulbach attempts to achieve "high processing rates" in a different way, the skilled artisan would not have considered Kono's technique for increasing the speed of wire coating extrusion process. Prelim. Resp. 30–31. Rather, we note that "if a technique has been used to improve one device, and a person of ordinary skill in the art would

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[9] We note Kaulbach does not expressly recite the units when it discloses that the "MFI of the polymer is ≥15." Ex. 1009, 3:43–44. Because Patent Owner does not allege otherwise, but rather appears to concede the MFI units are "g/10 min" (Prelim. Resp. 29–30), we assume for purposes of this Decision that Kaulbach's disclosure of "≥15" is a disclosure of "greater than or equal to 15 g/10 min."

recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007).

Therefore, based on the current record, we agree that Petitioner has established a reasonable likelihood that claims 1–7 are obvious in view of Kaulbach.

III. CONCLUSION

For the foregoing reasons, we are persuaded that the Petition establishes a reasonable likelihood that Petitioner would prevail on its challenge to claims 1–7 of the '609 patent.

As discussed above, we question the sufficiency of Petitioner's contentions with respect to certain grounds, but nevertheless institute an *inter partes* review of claims 1–7 on all asserted grounds. Although we exercise our discretion and institute review, we remind the parties that we have not yet made a final determination as to the patentability of any of the challenged claims.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review is hereby instituted as to claims 1–7 of the '609 patent with respect to the grounds set forth in the Petition; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial commencing on the entry date of this decision.

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APPENDIX F

Trials@uspto.gov Paper No. 12
571-272-7822 Entered: November 13, 2018

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DAIKIN INDUSTRIES LTD. and DAIKIN AMERICA, INC.,
Petitioner,

v.

THE CHEMOURS COMPANY FC, LLC,
Patent Owner.

Case IPR2018-00993
Patent 8,076,431 B2

Before JO-ANNE M. KOKOSKI, KRISTINA M. KALAN, and SHELDON M. MCGEE, *Administrative Patent Judges*.

MCGEE, *Administrative Patent Judge*.

DECISION
Institution of *Inter Partes* Review
35 U.S.C. § 314(a)

I. INTRODUCTION

A. Background

Daikin Industries Ltd. and Daikin America, Inc. (collectively, "Petitioner") filed a Petition requesting an *inter partes* review of claims 1–7 of U.S. Patent No. 8,076,431 (Ex. 1001, "the '431 patent"). Paper 1 ("Pet."). The Chemours Company FC, LLC ("Patent Owner") filed a Preliminary Response to the Petition. Paper 7 ("Prelim. Resp.").

Along with its Preliminary Response, Patent Owner filed a Statutory Disclaimer of claims 1, 2, and 5–7 of the '431 patent. Prelim. Resp. 1; Ex. 2005. As a result of Patent Owner's Statutory Disclaimer of some, but not all, of the challenged claims, Petitioner sought authorization to file a reply to address the legal effect of Patent Owner's disclaimer. On September 5, 2018, a telephone conference was held among respective counsel for Petitioner, Patent Owner, and Judges Kokoski, Kalan, and McGee to determine whether good cause exists for Petitioner to file a reply to Patent Owner's Preliminary Response. A transcript of the telephone call was filed by Petitioner. Paper 9; Ex. 1037. We determined that Petitioner had demonstrated good cause to file a reply, and authorized limited briefing from both parties on the potential legal effect of Patent Owner's disclaimer of some, but not all, claims of the '431 patent. Paper 8. Petitioner timely filed a reply (Paper 10, "Pet. Reply"), to which Patent Owner filed a sur-reply (Paper 11, "PO Sur-Reply").

B. Legal Effect of Patent Owner's Statutory Disclaimer

We begin by addressing the legal effect of Patent Owner's Statutory Disclaimer of claims 1, 2, and 5–7 of the '431 patent. Ex. 2005.

In its Reply to Patent Owner's Preliminary Response, Petitioner asserts Patent Owner likely chose to statutorily disclaim some, but not all, claims of the '431 patent because doing so would, according to Petitioner, "improve its odds against the backdrop of *SAS Institute Inc. v. Iancu* . . . —*i.e.*, institution for *any* challenged claim requires institution for every challenged claim—of avoiding institution by disclaiming most of its claims and leaving only dependent claim 3 and 4." Pet. Reply 1. Thus, Petitioner asks the Board to enter adverse judgment against the disclaimed claims and "estop [Patent Owner] under 37 C.F.R. § 42.73(d) from contradicting its disclaimer and taking actions inconsistent with the adverse judgment," namely, defending the patentability of remaining claims 3 and 4. *Id.* at 1–2.

In support of its desired relief, Petitioner cites to *Smith & Nephew, Inc. v. Arthrex, Inc.*, Case IPR2016-00917, slip op. at 8–9 (PTAB Sept. 21, 2016) (Paper 12), *aff'd sub nom*, 880 F.3d 1345 (Fed. Cir. 2018), and avers the Board has power to construe Patent Owner's Statutory Disclaimer as a request for adverse judgment under Rule 42.73(b). Pet. Reply 2. Petitioner states that the Board exercised such power in the *Smith & Nephew* case "to preclude the patent owner from arguing for the patentability of claims patentably indistinct from those disclaimed." *Id.* Petitioner reasons that similar circumstances exist in the present case because claims 3 and 4 are, according to Petitioner, patentably indistinct from claim 1, from which they depend. *Id.* Petitioner asserts that allowing Patent Owner to rely on limitations appearing in a disclaimed claim (i.e., claim 1) to defend patentably indistinct dependent claims (i.e., claims 3 and 4) "frustrates the Board's articulated policies of finality and repose." *Id.* Petitioner further points to Rule 42.73(b) which sets forth actions that may be construed as a request for adverse judgment. *Id.* at 3. Petitioner then avers that such examples are non-exhaustive and, thus, do not preclude the rule's application to the current facts. *Id.*

In its Sur-Reply, Patent Owner disagrees that its statutory disclaimer of some, but not all, claims challenged in the Petition should be construed by the Board as a request for adverse judgment on the disclaimed claims. PO Sur-Reply 1–4. Rather, Patent Owner argues that, under Rule 42.73(a), a "judgment" "disposes of all issues that were . . . raised and decided," and that because claims 3 and 4 remain in the trial, undecided issues likewise remain, and "any type of judgment, much less adverse judgment, is thus inappropriate." *Id.* at 1–2.

Patent Owner also points to Rule 42.107(e), which specifically allows for disclaimer of one or more claims prior to a decision on institution, and provides that "[n]o *inter partes* review will be instituted based on disclaimed claims." PO Sur-Reply 3. Patent Owner also contends that the Board's Trial Practice Guide is consistent with the aforementioned Rule because it allows Patent Owner "to streamline the proceedings" by disclaiming one or more claims. *Id.* Patent Owner contends that the Trial Practice Guide "further differentiates between the situations where no challenged claims remain and where one or more challenged claims remain," but, using Petitioner's logic, there would be no difference between these situations. *Id.*

Patent Owner also argues that, because adverse judgment is not appropriate under the instant facts, estoppel should not apply to its arguments against the remaining claims in the trial, i.e., claims 3 and 4. PO Sur-Reply 4. According to Patent Owner, dependent claims 3 and 4 are patentably distinct from disclaimed independent claim 1, and, as such, it is proper to rely on limitations appearing in disclaimed claim 1 because they are present in dependent claims 3 and 4 themselves. *Id.* at 4–5.

We agree with Patent Owner and decline to enter an adverse judgment against disclaimed claims 1, 2, and 5–7. By extension, no estoppel attaches to Patent Owner's arguments made as to remaining claims 3 and 4. Our reasoning follows.

First, Rule 42.107(e) specifically contemplates the current situation. Namely, a patent owner, in a preliminary response, "may file a statutory disclaimer under 35 U.S.C. § 253(a) . . . disclaiming one or more claims in the patent." 37 C.F.R. § 42.107(e). Under such circumstances, the rule is clear—"[n]o *inter partes* review will be instituted based on disclaimed claims"—and is notably silent as to the adverse judgment and estoppel Petitioner seeks.

Second, as noted by Patent Owner (PO Sur-Reply 1–2), Rule 42.73 indicates that a "judgment" is a disposition "of *all* issues that were, or by motion reasonably could have been, *raised and decided*." 37 C.F.R. § 42.73(a) (emphasis added); *see also* 37 C.F.R.

§ 42.2 (defining "judgment" as "a final written decision by the Board, or a termination of the proceeding"). Here, Petitioner challenges claims 1–7 of the '431 patent. Pet. 14. Although Patent Owner disclaimed claims 1, 2, and 5–7 in the Preliminary Response, challenged claims 3 and 4 remain, and, as such, the issues Petitioner "raised" specific to those claims have yet to be "decided." Here, we emphasize in particular that Petitioner's Ground 2, as originally presented and before filing of the disclaimer, includes only claims 3 and 4. Pet. 16, 30–31. Estopping Patent Owner from defending these claims by mere virtue of their dependence from a disclaimed claim, as Petitioner asks us to do, would undermine our ability to determine whether Petitioner's Ground 2 meets the "reasonable likelihood" standard governing *inter partes* review. *See* 35 U.S.C. § 314(a) (stating institution of an *inter partes* review may not be authorized unless it is determined "that the information presented in the petition filed under section 311 *and any response filed under section 313* shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." (emphasis added)). Estoppel would similarly impact our review of the remaining challenges that include claims 3 and 4. Pet. 32–59. In other words, applying the estoppel doctrine to non-disclaimed claims 3 and 4 here would prevent us from doing precisely what the statute requires, i.e., fully considering the reasons set forth in the Preliminary Response as to "why no inter partes review should be instituted" as to those claims. 35 U.S.C. §§ 313, 314.

Third, contrary to what Petitioner's Reply suggests, Patent Owner does not rely solely on the limitations recited in disclaimed claim 1 when defending the patentability of remaining claims 3 and 4. Pet. Reply 2; *see also id.* at 4 (discussing only Patent Owner's arguments specific to the Grounds 4 and 5 challenges based on the Kono[1] reference). Rather, Patent Owner's arguments directed to Petitioner's Ground 2––which, again, is limited to claims 3 and 4 (Pet. 16, 30–31)—are largely directed to the alkali metal concentration recited in dependent claims 3 and 4. Prelim. Resp. 9–12; *see also id.* at 23, 26 (arguing that the reference cited in Petitioner's Ground 6 based on obviousness of claims 3 and 4 over Kaulbach[2] does not "appreciate the criticality of minimizing or eliminating alkali metals.").

Fourth, the *Smith & Nephew, Inc. v. Arthrex, Inc.* case upon which Petitioner relies is inapposite and does not compel a result different than we reach here. As Patent Owner correctly notes (PO Sur-Reply 2), and Petitioner itself recognizes (Pet. Reply 2–3), the Board in that case declared an adverse judgment after the patent owner disclaimed all claims. *Smith & Nephew, Inc. v. Arthrex, Inc.*, Case IPR2016-00917 (PTAB Sept. 21, 2016) (Paper 12). The patent owner's disclaimer in Smith & Nephew falls squarely within the text of rule governing what may be construed as an adverse judgment, because it was "such that the party has no remaining claim in the trial." 37

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[1] Ex. 1008, US 6,743,508 B2, issued June 1, 2004.

[2] Ex. 1009, Kaulbach et al., US 6,541,588 B1, issued April 1, 2003.

C.F.R. 42.73(b)(2). That is simply not the case here, because claims 3 and 4 remain in this proceeding.

In view of the above, we decline Petitioner's request to i) enter adverse judgment against disclaimed claims 1, 2, and 5–7 of the '431 patent, and ii) estop Patent Owner from defending the patentability of claims 3 and 4, which remain in this proceeding.

C. Institution of Inter Partes Review

i. Statutorily Disclaimed Claims 1, 2, and 5–7

On April 24, 2018, the United States Supreme Court held that a decision to institute an *inter partes* review under 35 U.S.C. § 314 may not proceed on fewer than all claims challenged in the petition. *SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348, 1355 (2018). The Court recognized, however, that all "claims challenged 'in the petition' will not always survive to the end of the case; some may drop out thanks to the patent owner's actions." *Id.* at 1357.

Here, challenged claims 1, 2, and 5–7 of the '431 patent have been statutorily disclaimed by Patent Owner. Ex. 2005. 37 C.F.R. § 42.107(e) instructs that "[n]o *inter partes* review will be instituted based on disclaimed claims." Thus, the rule precludes institution of an *inter partes* review on the basis of disclaimed claims 1, 2, and 5–7 of the '431 patent.

ii. Claims 3 and 4

We now turn to the merits of the issues raised regarding claims 3 and 4 of the '431 patent in the Petition and the Preliminary Response. We have jurisdiction under 35 U.S.C. § 314, which provides that an *inter partes* review may not be instituted "unless . . . there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." 35 U.S.C. § 314(a). Upon consideration of the Petition and the Preliminary Response, and the evidence of record, we determine that Petitioner has shown a reasonable likelihood that it would prevail in showing the unpatentability of at least one of claims 3 and 4.

Accordingly, we institute an *inter partes* review of claims 3 and 4 of the '431 patent.

D. Related Proceedings

The parties *Id*entify the following district court proceeding as related to the '431 patent: *Chemours Company FC, LLC v. Daikin Industries, Ltd.*,, U.S. District Court for the District of Delaware, Civil Action No. 1:17-cv-01612-GMS. Pet. 60; Paper 4, 2.

E. The '431 Patent (Ex. 1001)

The '431 patent, titled "High Melt Flow Fluoropolymer," issued on December 13, 2011. Ex. 1001, at [54], [45]. The '431 patent relates to partially-crystalline fluoropolymers that are copolymers of tetrafluoroethylene ("TFE") and hexafluoropropylene ("HFP"). *Id.* at 2:7–10. Such copolymers, also known as fluorinated ethylene-propylene or "FEP" copolymers, "can be extruded at high speed onto conductor over a broad polymer melt temperature range to give insulated wire of high quality." *Id.* at 1:59–61; 7:53–55; Ex. 1002 ¶ 24.

F. Challenged Claims

Claims 3 and 4 of the '431 patent each depend from and include the limitations of now disclaimed independent claim 1. Disclaimed claim 1, and remaining claims 3 and 4 are reproduced below:

> 1. A partially-crystalline copolymer comprising tetrafluoroethylene [TFE], hexafluoropropylene [HFP] in an amount corresponding to hexafluoropropylene index (HFPI) of from about 2.8 to 5.3, said copolymer having less than about 50 ppm alkali metal ion, having a melt flow rate of within the range of about 30±3 g/10 min as determined by ASTM D1238 at 372° C., and having no more than about 50 unstable endgroups/10^6 carbon atoms.
>
> 3. The polymer of claim 1 wherein said copolymer has less than about 10 ppm alkali metal ion.
>
> 4. The polymer of claim 1 wherein said copolymer has less than about 5 ppm alkali metal ion.

Ex. 1001, 6, 10:9–22.

G. The Asserted Grounds of Unpatentability

Reference(s)	**Basis**	**Claims Challenged**
Hiraga,[3] Kaulbach	§ 103(a)	3, 4
Hiraga	§ 103(a)[4]	3, 4
Kono	§ 102(e)(2) and § 103(a)	3, 4
Kaulbach	§ 103(a)	3, 4

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[3] Ex. 1025, Hiraga et al., JP 2002-249585, published September 6, 2002 (as translated).

[4] Petitioner's anticipation challenge based on Hiraga is now moot in view of Patent Owner's disclaimer of all claims included in this challenge.

II. ANALYSIS

A. Claim Construction[5]

In an *inter partes* review, claim terms in an unexpired patent are interpreted according to their broadest reasonable constructions in light of the Specification of the patent in which they appear. See 37 C.F.R. § 42.100(b); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2142 (2016). Under the broadest reasonable construction standard, claim terms are presumed to have their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. In *re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Only terms that are in controversy need to be construed, and then only to the extent necessary to resolve the controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

Petitioner offers proposed constructions for two recited limitations, namely, "about 30±3 g/10 min" and "about 50 unstable endgroups." Pet. 16–20. The latter construction concerns the phrase "unstable endgroup." *Id.* at 20. Petitioner notes that although the '431 patent exemplifies four unstable endgroups ($–CONH_2$, $–CF_2CH_2OH$, $–COF$, and $–COOH$), "other unstable endgroups are also possible," such as ethyl endgroups.

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[5] The revised claim construction standard for interpreting claims in *inter partes* review proceedings as set forth in the final rule published October 11, 2018 does not apply to this proceeding because the new "rule is effective on November 13, 2018 and applies to all IPR, PGR and CBM petitions filed on or after the effective date." Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51340 (Oct. 11, 2018) (to be codified at 37 C.F.R. pt.42).

Id. (citing Ex. 1002, 34 ¶¶ 77, 78; Ex. 1035, 5). Thus, Petitioner urges that the broadest reasonable construction of the term "unstable endgroup" includes such "endgroups resulting from any FEP polymerization process" and not only those species exemplified in the '431 patent. *Id.* Patent Owner accepts Petitioner's proposed claim construction for the term "unstable endgroups." Prelim. Resp. 9 n.1.

For purposes of this Decision, we construe the term "unstable endgroups" to include not only those unstable endgroups exemplified in the '431 patent, but "[all] unstable endgroups resulting from any FEP polymerization process" as agreed to by the parties. Based on the record before us, we determine that no other claim terms require an explicit construction at this time.

B. Asserted Obviousness Ground based on Hiraga and Kaulbach

Petitioner asserts that claims 3 and 4 of the '431 patent are unpatentable as obvious under 35 U.S.C. § 103(a) over Hiraga in view of Kaulbach. Pet. 30–31; Exs. 1009, 1025. Petitioner relies on the Declaration of Dr. Robert Iezzi (Ex. 1002) to support its obviousness challenge. *Id.* at 30–31; Ex. 1002, 48–50.

i. Overview of Hiraga (Ex. 1025)

Hiraga discloses methods of modifying a fluoropolymer via a melt-kneading process. Ex. 1025, 1 at (57). Hiraga discloses that the modification method efficiently stabilizes unstable groups contained on the melt-processable fluoropolymer, homogenizes and prevents a decrease in the fluoropolymer's molecular weight, and increases the fluoropolymer's processability, thus enabling the production of "a molded article free of air bubbles and coloration." *Id.* ¶ 11.

Hiraga's method "may be applied to any melt-processable fluorine-containing polymer having unstable groups, but is particularly effective as a stabilization treatment for the unstable groups of" copolymers containing "tetrafluoroethylene (TFE) [and] hexafluoropropylene (HFP)," also known as "FEP" polymers. *Id.* ¶¶ 19, 26. According to Hiraga, unstable groups include vinyl end groups ($–CF=CF_2$) and acid fluoride end groups (–COF), and may cause bubbles and cavities to form in the final product. *Id.* ¶ 3.

To achieve "the most homogeneous molecular weight possible, and not simply stabilize the unstable groups," Hiraga teaches that it is important "that water is not present" during the first step, i.e., "step (A)," "in which the treatment with oxygen-containing gas is carried out." *Id.* ¶ 30. Because the fluoropolymer's unstable groups cannot be stabilized in the presence of oxygen alone, however, it "is melt-kneaded in the presence of oxygen while further aggressively introducing water, thereby both stabilizing the unstable groups and also oxidizing to remove coloration substances (step (B))." *Id.* ¶ 41. Hiraga discloses that a reaction accelerator may be added before or during either step A or B, and that such reaction accelerators may be a compound containing an alkaline metal, an alkaline earth metal, an ammonium salt, ammonia, an alcohol, an amine, or a salt thereof. *Id.* ¶¶ 48–49.

Hiraga discloses Comparative Example 1 wherein a modified FEP polymer containing 15 ppm potassium was processed to yield a FEP copolymer with a melt flow rate of 30.0 g/10 min, and zero unstable groups per 106 carbons. *Id.* ¶¶ 107, 114–117.

ii. Overview of Kaulbach (Ex. 1009)

Kaulbach discloses "melt-processable tetrafluoroethylene (TFE)/hexafluoropropylene (HFP) copolymer melt pellets having an improved processability for wire and cable application and to a method of using this polymer to coat wire and cable conductors." Ex. 1009, 1:9–13. Kaulbach teaches that metal contaminants in the copolymer may cause it to degrade or decompose at high processing temperatures, which may in turn cause discoloration and "a build up of die drools." *Id.* at 2:4–8. According to Kaulbach, "[d]ie drools are accumulations of molecular fractions of the polymer at the surface of the die exit" and "impair the coating processing." *Id.* at 2:8–10. To assist with this and other potential problems, Kaulbach instructs that the copolymer "should be made more thermally stable not only by eliminating the thermally unstable endgroups but also by avoiding metal contaminants." *Id.* at 2:27–29. Kaulbach discloses that a "preferred version of the polymerization recipe here is an alkali metal salt-free recipe." *Id.* at 4:44–45.

iii. Analysis

In asserting that claims 3 and 4 are unpatentable as being obvious over the combined disclosures of Hiraga and Kaulbach, Petitioner specifically points to Hiraga's Comparative Example 1, which is a FEP polymer containing 15 ppm of potassium, an alkali metal. Pet. 30. Petitioner then turns to Kaulbach's disclosure regarding certain benefits that may be realized by avoiding metal contamination, specifically alkali metal contamination, when processing melt-processable FEP. *Id.*

Petitioner asserts that the skilled artisan, "[a]rmed with the teachings of Kaulbach . . . would have been motivated to avoid using alkali metal in Hiraga's Comparative Example 1, and instead, would have employed one of the other reaction accelerators Hiraga discloses." *Id.* at 30–31. Petitioner urges that "[d]oing so would result in a final copolymer with no potassium (or other alkali metal)," thus meeting the "less than about 10 ppm alkali metal ion" and "less than about 5 ppm alkali metal ion" limitations in claims 3 and 4, respectively. *Id.* at 31.

Petitioner asserts further that the disclosures of Hiraga and Kaulbach are properly combinable because each reference is "directed to the same technology and seek to obtain the same benefits," and also focus on preparing "copolymers of high [melt flow rate] that are stabilized to remove unstable endgroups." *Id.* As such, the skilled artisan, upon considering Hiraga's Comparative Example 1, "would have logically looked to Kaulbach for ways to further improve the melt-processability of the copolymer," and would have reasonably expected "improved processability and low incidences of flaws" in a FEP copolymer by avoiding metal contamination therein as taught by Kaulbach. *Id.*

Patent Owner first argues that neither Hiraga nor Kaulbach "discloses or suggests the importance of minimizing metal ion concentration." Prelim. Resp. 10. Patent Owner points to Hiraga's use of alkali metal salts as polymerization initiators and reaction accelerators, and argues that Kaulbauch "is primarily concerned with non-alkali metals—such as iron, chromium, and nickel—and teaches that such metals can lead to polymer decomposition." *Id.* at 11. Patent Owner alleges that Petitioner "relies on one lone sentence in Kaulbach stating that alkali metal salt-free recipes are preferred," but that Kaulbach fails to explain why there is such a preference and allows for alkali metal salts such as potassium and sodium to be used. *Id.* 11–12. Patent Owner thus urges that "taken as a whole, Kaulbach does not appreciate the criticality of minimizing alkali metal salt concentration." *Id.* at 12.

Based on this preliminary record, we disagree with Patent Owner. We note that Petitioner does not solely rely on "one lone sentence" within Kaulbach to support its argument as Patent Owner contends. Prelim. Resp. 11. Rather, Petitioner *Id*entifies four passages in Kaulbach. Pet. 30 (citing Ex. 1009, 2:4–11, 2:27–31, 4:45–46, and 5:14–17). Kaulbach's disclosure as *Id*entified by Petitioner goes beyond merely discouraging the presence of *alkali* metal salts in FEP polymers, but rather instructs to avoid "metal contaminants" generally in such polymers. *See* Ex. 1009, 2:4–6, 27–31 (explaining that metal contamination should be avoided because "[m]etal contaminants are difficult to cope with" and "may result in degradation and decomposition of the copolymer at high processing temperatures" leading to problems with the coating process such as die drool); *see also id.* at 4:19–20 (*Id*entifying metal contaminants such as iron, nickel, and chromium "in particular," but not limiting metal contaminants to only these three species). Therefore, because

Kaulbach discusses specific problems known to occur when processing FEP polymers that contain metal contaminants generally, i.e., metal contamination not necessarily limited to alkali metal salts, we decline to read Kaulbach's disclosure as narrowly as Patent Owner urges.

Furthermore, we are not persuaded by Patent Owner's argument that because Kaulbach "teaches that potassium persulfate and sodium bicarbonate may be used" in the same paragraph in which Kaulbach discloses a preference for "an alkali metal salt-free recipe," Kaulbach does not appreciate why alkali metal salts should be minimized. Prelim. Resp. 11–12; Ex. 1009, 4:28–34, 44–45. Here, Kaulbach teaches that an initiator such as ammonium or potassium persulfate may be used in the polymerization reaction. Ex. 1009, 4:27–30. Kaulbach further discloses that buffers such as ammonia, ammonium carbonate, and sodium bicarbonate "can be incorporated in the recipe." *Id.* at 4:32–33. Kaulbach does not state, however, that such initiators or buffers are required components of the polymerization reaction, but instead indicates that they "may be" or "can be" used. *Id.* at 4:27–30, 32–33. Also, should an initiator and/or buffer be used, Kaulbach provides alkali-metal free options from which to choose. *Id.* Thus, Kaulbach's teaching that potassium persulfate and sodium bicarbonate may be used does not negate Kaulbach's overall teaching that metal contaminants are problematic and should be avoided. *See In re Fritch*, 972 F.2d 1260, 1264 (Fed. Cir. 1992) ("It is well settled that a prior art reference is relevant for all that it teaches to those of ordinary skill in the art.").

iv. Conclusion

For these reasons, based on the record currently before us, including Petitioner's claim chart demonstrating where each limitation of claim 1 may be found in Hiraga (Pet. 26–27), portions of the Hiraga and Kaulbach references identified by Petitioner, the supporting Declaration, and Petitioner's proffered reasons to combine these references (Pet. 30–31), we conclude that Petitioner has demonstrated a reasonable likelihood that it would prevail in showing that claims 3 and 4 are unpatentable as being obvious over Hiraga and Kaulbach.

C. Asserted Obviousness Ground Based on Hiraga Alone

Petitioner asserts that Hiraga alone renders claims 3 and 4 of the '431 patent[6] obvious under 35 U.S.C. § 103(a) because the skilled artisan would have found it obvious to substitute Hiraga's melt-kneading process with an alternative fluorination process, "or to use melt-kneading only to adjust the [melt flow rate] of the copolymer and separately remove unstable endgroups using fluorination." Pet. 32 (citing Ex. 1002 ¶¶ 137–140). Petitioner asserts that the skilled artisan would have been motivated to use such a fluorination process in Hiraga "for many reasons," including because the skilled artisan would have understood that fluorination is "an alkali metal free stabilization method," and also "provides benefits compared to other stabilization techniques, such as Hiraga's wet-heat treatment." Pet. 32 (citing Ex. 1002

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[6] Although Petitioner challenges claims 1–7 (Pet. 32–33), we need only consider claims 3 and 4 in view of the statutory disclaimer of claims 1, 2, and 5–7. Ex. 2005.

¶ 139). Petitioner points to evidence that purportedly demonstrates fluoropolymers containing endgroups that are stabilized via a fluorination process have "better electrical properties than those untreated or treated using different means." *Id.* at 32–33 (citing Ex. 1027, 3:34–39).

Patent Owner challenges Petitioner's assertion that it would have been obvious to modify Hiraga's process in the manner proposed. Prelim. Resp. 12–15. Specifically, Patent Owner notes Hiraga's emphasis on a two-step melt-kneading process, describing it as "the present invention," and that the proffered substitution "would eviscerate [Hiraga's] core invention." *Id.* at 13. Patent Owner also questions how fluorination would achieve Hiraga's stated objective (Ex. 1025 ¶ 30) to "adjust the molecular weight and create a polymer with the most homogeneous molecular weight possible, and not simply stabilize the unstable groups," because Petitioner failed to provide evidence to demonstrate "that fluorination has any impact on molecular weight." Prelim. Resp. 14. Patent Owner also contends that Hiraga does not recognize the need for minimizing alkali metal salt concentration, because it teaches such salts as polymerization initiators and reaction accelerators. *Id.* Additionally, Patent Owner avers that "Hiraga does not appreciate the importance of the claimed high [melt flow rate] range," because Comparative Example 1 achieved melt flow rates of 30.0 and 38.1 g/10 min which each fall outside a target range "of between 22.5 to 28.0 g/10 min." *Id.* at 14–15.

For several reasons, we do not agree that Petitioner has established a reasonable likelihood that claims 3 and 4 are obvious based on the disclosure of Hiraga alone.

First, as noted by Patent Owner (Prelim. Resp. 14), Hiraga is not only focused on stabilizing unstable endgroups of fluoropolymers, but also seeks to tailor the fluoropolymer's molecular weight in order to "create a polymer with the most homogeneous molecular weight possible." Ex. 1025 ¶ 30. Petitioner fails to explain how, or provide evidentiary support to reasonably establish that, substituting both steps of Hiraga's two-step melt-kneading process with a fluorination process would have any impact on a fluoropolymer's molecular weight. We note Petitioner's recognition that a polymer's molecular weight is inversely related to its melt flow rate. Pet. 9 (citing Ex. 1009, 6:33–35; Ex. 1006, 3:21–27; Ex. 1002 ¶ 50). Thus, it is unclear what impact, if any, a fluorination process would have on the melt flow rate of the polymer disclosed in Hiraga's Comparative Example 1—i.e., the polymer that Petitioner relies on in its obviousness challenge. Pet. 32–33. We emphasize that, prior to melt-kneading, Comparative Example 1 has a melt flow rate outside the claimed range of "about 30±3 g/10 min," i.e., 25 g/10 min. Ex. 1025 ¶¶ 107, 114, 117. Only after melt-kneading does the polymer exhibit a melt flow rate falling within the recited range. Although Petitioner urges that it likewise would have been obvious to modify the fluoropolymer's molecular weight by melt-kneading "and separately remove unstable endgroups using fluorination," Petitioner does not sufficiently explain why the skilled artisan would do so. Pet. 32–33.

Furthermore, even if the skilled artisan were to substitute one or both of Hiraga's melt-kneading steps with a fluorination process as proposed by Petitioner, Petitioner has not established that the proffered substitution would yield the alkali metal ion concentrations of "less than about 10 ppm" and "less than about 5 ppm" recited in claims 3 and 4, respectively. Petitioner asserts that "Hiraga's melt-kneading process to eliminate unstable endgroups can introduce alkali metal to the copolymer." *Id.* Petitioner has not explained, however, how melt-kneading the polymer of Hiraga's Comparative Example 1 for the limited purpose of adjusting its melt flow rate would result in a polymer with the recited alkali metal ion concentrations. Such explanation is particularly necessary here because Hiraga's Comparative Example 1 polymer contains a potassium concentration of 15 ppm *prior to* the melt-kneading process. Ex. 1025 ¶¶ 107, 114. Additionally, notwithstanding the deficiencies outlined above regarding the unknown impact of fluorination on a given polymer's molecular weight, Petitioner fails to sufficiently address how eliminating both of Hiraga's melt-kneading steps in favor of a fluorination process of Comparative Example 1 would yield the recited metal concentrations.

We are, therefore, not persuaded that Petitioner has established a reasonable likelihood of establishing that claims 3 and 4 are unpatentable over the disclosure of Hiraga alone.

D. Asserted Anticipation and Obviousness Grounds based on Kono

Petitioner asserts that claims 3 and 4 of the '431 patent are anticipated by and/or rendered obvious in view of Kono. Pet. 33–50.

i. Overview of Kono (Ex. 1008)

Kono discloses pellets which comprise "a copolymer obtained by copolymerizing monomer components containing tetrafluoroethylene (TFE) and hexafluoropropylene (HFP)," also known as a "FEP pellet." Ex. 1008, 3:32–36. Kono discloses that the inventive FEP pellet is used in a coating extrusion process for insulating a core wire, i.e., by melting the FEP pellet "by heating within an extruder for coating a core wire and extruded from a die, and then drawn down by coating the core wire to thereby form an insulated cable." *Id.* at 4:29–34.

Kono discloses that the extrusion process with the inventive FEP pellet can be carried out at a speed of 2800 ft/min when the adhesive strength between the insulating material and the core wire is 0.8 kg or more. *Id.* at 4:42–50. Kono hypothesizes that the "excellent adhesive strength" exhibited by the inventive FEP pellets when extruded may be due to the presence of a certain functional group, also known as an "adhesion factor" or, if the adhesion factor is located at end of the polymer, as an "adhesion terminus." *Id.* at 5:1–9. Kono teaches that the functional group is "not particularly limited as long as it contributes to enhanced adhesion with the core wire at high temperature, and includes, for example, a functional group which is generally known to be unstable at high temperature." *Id.* at 5:14–18. Kono *Id*entifies several such known functional groups, including –COOM, –SO_3M, –OSO_3M, –SO_2F, –SO_2C1, –COF, –CH_2OH, –$CONH_2$, and –$CF{=}CF_2$, where M is selected from an alkyl group, a hydrogen atom, a metallic cation and a quaternary ammonium cation. *Id.* at 5, 5:18–22.

Kono discloses that the number of functional groups located at the terminal portion of the polymer depends on a number of factors, including the polymer's melt flow rate and the monomers present therein. *Id.* at 5:23– 27.

Kono discloses example pelletized FEP powders where, *inter alia*, the number of certain functional groups (i.e., "adhesion terminus" groups) per 10^6 carbon atoms were measured. *Id.* at 12:11–16:47. The "adhesion terminus" groups measured for Kono's Examples 1–7 and Kono's Comparative Examples 1–5 were limited to –COF, –COOH, and –CH_2OH. *Id.* at 15:1–18:20.

ii. Anticipation Analysis

Petitioner asserts that claims 3 and 4 are anticipated by Kono because "Kono discloses copolymers in Example 2 and Comparative Example 3 meeting each and every limitation of" these claims. Pet. 35. Petitioner provides a detailed explanation alleging where each limitation can be found in Kono for these claims. *Id.* at 35–45, 47–48 (citing Ex. 1002 ¶¶ 142–172).

Patent Owner challenges Petitioner's position that claims 3 and 4 are anticipated by Kono. Prelim. Resp. 15–20. Specifically, Patent Owner avers that Petitioner's anticipation challenge fails because Kono does not disclose a FEP polymer "having no more than about 50 unstable endgroups per 10^6 carbon atoms" as required by claims 3 and 4. *Id.* at 15. According to Patent Owner, using Petitioner's construction of the limitation "unstable endgroup," there is "no evidence demonstrating that Kono's FEPs necessarily lack any other unstable endgroups" beyond those measured, i.e., –COOH, –COF, and $–CH_2OH$. *Id.*; *see also id.* at 16–20. According to Patent Owner, Kono's disclosure of 15–150 unstable endgroups per million (i.e., 10^6) carbon atoms does not include endgroups other than –COOH, –COF, and $–CH_2OH$. *Id.* at 16. Further, Patent Owner contends that Kono's broad range of 15–150 for the –COOH, –COF, and $–CH_2OH$ endgroups does not anticipate the claimed range of "no more than about 50 unstable endgroups/10^6 carbon atoms," which includes unstable endgroups other than those disclosed in Kono. *Id.* at 17.

We agree with Patent Owner that, on this record, Petitioner fails to establish a reasonable likelihood that Kono anticipates claims 3 and 4 of the '431 patent. In particular, Petitioner fails to provide sufficient evidence to establish that Kono discloses a FEP polymer with the recited number of unstable endgroups, i.e., "no more than about 50 unstable endgroups/106 carbon atoms." We begin with Petitioner's claim construction of the term "unstable endgroups" (Pet. 20), which we adopted for purposes of this Decision (Section II.A., *supra*), namely, that the term "unstable endgroups" includes not only those unstable endgroups exemplified in the '431 patent, but "all unstable endgroups resulting from any FEP polymerization process." Such unstable endgroups include ethyl groups ($–CF_2CH_2CH_3$). Ex. 1002 ¶ 78; Ex. 1035 ¶ 2.6; see also Ex. 1008, 5:14–22 (reciting various known terminal functional groups that are "unstable at high temperature"); Ex. 1010, 5:38–39 ("[t]he presence of methanol can also lead to methyl ester ends ($–CO_2CH_3$)"); Ex. 1025 ¶¶ 3, 34, 44 (*Id*entifying a vinyl group ($–CF{=}CF_2$) along with carboxylic acid (–COOH) and acid fluoride (–COF) groups as unstable groups).

Petitioner also cites to Kono's disclosure "that the number of $–CH_2OH$, –COOH, and –COF groups should be 15–150 per 10^6 carbon atoms." Pet. 41. However, as noted by Patent Owner, this range is specific to only three endgroups, and does not address other endgroups such as – $CONH_2$, methyl ester groups, and vinyl groups. Prelim. Resp. 16–17; Ex. 1008, 5:27–33. Simply stated, Petitioner's reliance on Kono's range of 15–150 $–CH_2OH$, –COOH, and –COF groups per million carbon atoms is insufficient to establish that Kono discloses "no more than about 50" of *all* possible unstable endgroups resulting from any FEP polymerization process per our construction of this limitation.

For the same reason, Petitioner's reliance on Kono's Example 2 and Comparative Example 3 likewise falls short of establishing anticipation of claims 3 and 4. Pet. 41–45. These specific embodiments only measured "the numbers of the respective groups – COF, –COOH and $–CH_2OH$." Ex. 1008, 12:57–59, Table 1. Notably, Kono does not indicate whether two of the four exemplary endgroups identified in the '431 patent are present, much less whether other possible unstable endgroups are present as well. This is particularly important here given how close the measured values already are to the claimed limit for all unstable endgroups; Kono's Example 2 contains 58 of the measured endgroups while Comparative Example 3 has 50 of such endgroups. We additionally emphasize Patent Owner's evidence that states that methanol may lead to unstable endgroups such as carbinol (–CH_2OH) and methyl ester endgroups (–CO_2CH_3). Ex. 1010, 5:35–51.

For these reasons, we agree with Patent Owner that, on this record, Petitioner fails to establish a reasonable likelihood that Kono anticipates claims 3 and 4.

iii. Obviousness Analysis

In support of its obviousness challenge, Petitioner relies on the same general disclosure of Kono as in its anticipation challenge, and additionally relies on Kono's Comparative Example 5 as well as Kono's disclosure of a fluorination process. Pet. 35–45, 47–50 (citing Ex. 1002 ¶¶ 142–172, 182–187).

Regarding Comparative Example 5, Petitioner acknowledges that Kono fails to disclose the recited melt flow rate "of within the range of about 30±3 g/10 min as determined by ASTM D1238 at 372° C." Pet. 40. Petitioner alleges, however, that "Kono teaches copolymers with [a melt flow rate] of 30 g/10 min or more, and preferably 30–45 g/10 min." *Id.* (citing Ex. 1008, 6:12–28). In view of the overlap between the claimed melt flow rate with Kono's preferred range of 30–45 g/10 min, as well as "the closeness of Comparative Example 5's" melt flow rate to that claimed, Petitioner asserts that the recited range would have been obvious. *Id.* Petitioner asserts that the skilled artisan "would have been able to optimize" Kono's reaction parameters as set forth in Comparative Example 5 "to achieve copolymers meeting the limitations of [claims 3 and 4] through routine experimentation and with a reasonable expectation of success." *Id.*

Petitioner further asserts that it would have been obvious for the skilled artisan to employ a fluorination process "for a reduced time or at a reduced temperature" to treat the polymers of Kono's Example 2 and Comparative Example 3 in order "to reduce the number of unstable endgroups to the minimum necessary for sufficient adhesion strength." Pet. 49–50. According to Petitioner, copolymers subjected to a fluorination process "were known to have benefits over those unstabilized or stabilized by other procedures, such as the wet-heat treatment of Kono, including better electrical properties obtained by converting $–CF_2H$ endgroups to $–CF_3$ endgroups." *Id.*

Patent Owner does not directly address Petitioner's assertions regarding Comparative Example 5's melt flow rate, but instead focuses on Kono's disclosure of only a limited number of unstable endgroups for all embodiments, including Comparative Example 5. Prelim. Resp. 17–21. Patent Owner argues that it would not have been obvious to fluorinate the FEP polymers of Kono because doing so would "undermine the purpose of Kono: to produce FEP pellets with unstable endgroups so as to increase adhesive strength between the FEP and the wire." *Id.* at 21. Patent Owner notes that Kono disparages Comparative Example 5 because it has no "reported unstable –COF, –COOH, and $–CH_2OH$ groups." *Id.* As such, Patent Owner argues that the skilled artisan would not have been motivated to fluorinate Kono's FEP polymers, or use another terminal group stabilization treatment, and that Petitioner's allegation is "based solely on hindsight." *Id.* at 22–23.

We agree with Patent Owner. As we explained with respect to Petitioner's anticipation challenge of claims

3 and 4 based on Kono, Petitioner does not establish sufficiently that Kono discloses the recited unstable endgroup limitation. *See supra* Section II.D.ii. We also determine that Petitioner fails to identify a sufficient reason for the skilled artisan to have modified the teachings of Kono to arrive at the recited unstable endgroup range. In that regard, Kono expresses a desire to maintain unstable endgroups because these groups "contribute[] to enhanced adhesion [of the FEP] with the core wire at high temperature." Ex. 1008, 5:14–16. Kono describes Comparative Example 5, which has zero –COF and –COOH endgroups,[7] as "inferior in adhesion strength" to Example 7 which has 21 –COOH groups. *Id.* at 18:36–40. Kono also states that Comparative Example 3, containing a total of 50 –COF, –COOH, and $-CH_2OH$ endgroups, is "inferior in at least one of the evaluation criteria" such as spark-out, cone-breaks and adhesive strength between the insulating material and the core wire. *Id.* at 15:50–59.

In view of these teachings, Petitioner does not explain sufficiently why the skilled artisan would have been motivated to employ a fluorination process to minimize or eliminate unstable endgroups. Nor has Petitioner explained how the skilled artisan would even arrive at what "a sufficient number of unstable endgroups" would be in designing the proffered fluorination process. Pet. 50. Thus, we agree with Patent Owner that Petitioner's obviousness challenge of claims 3 and 4 based on Kono employs impermissible hindsight. Prelim. Resp. 23.

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[7] We observe that Kono gives no measurement value for CH_2OH groups. Ex. 1008, 18:19.

For these reasons, we agree with Patent Owner that, on this record, Petitioner fails to establish a reasonable likelihood that Kono renders obvious claims 3 and 4.

E. Asserted Obviousness Ground based on Kaulbach

Petitioner asserts that claims 3 and 4 of the '431 patent are obvious in view of Kaulbach. Pet. 50–57 (citing Ex. 1002 ¶¶ 188–211). Petitioner specifically relies on Sample A11 of Kaulbach and alleges that "[i]n Sample A11, Kaulbach discloses a copolymer that renders obvious each and every limitation of claims [3 and 4] of the '431 patent." *Id.* at 51. Petitioner sets forth a detailed explanation of how Kaulbach's Sample A11 purportedly meets or renders obvious the recited limitations. *Id.* at 52–57. Patent Owner disagrees that it would have been obvious to adjust Sample A11's melt flow rate of 24 g/10 min[8] to be within the recited "range of about 30±3 g/10 min," and further challenges Petitioner's view that Kaulbach desires "an alkali-metal free recipe." Prelim. Resp. 23–27.

Based on the current record, we are not persuaded by Patent Owner's arguments that i) Kaulbach fails "to appreciate the criticality of minimizing or eliminating alkali metals," ii) "Kaulbach is primarily concerned with polymer decomposition from non-alkali metals—iron, chromium, and nickel," and iii) Kaulbach "expressly teaches that potassium persulfate and sodium bicarbonate—both alkali metal salts—may be used to prepare the FEP." Prelim. Resp.

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[8] The parties agree that Kaulbach incorrectly reports melt flow rate in units of g/min rather than in g/10 min. Pet. 53; Prelim. Resp. 24. For purposes of this Decision, we treat Kaulbach's disclosure of melt flow rate in g/min as g/10 min.

26. These arguments are similar to the arguments made by Patent Owner (*Id.* at 11–12) that we addressed above with respect to Petitioner's challenge based on Hiraga and Kaulbach, and are unpersuasive for the same reasons. See supra Section II.B.iii.

Turning now to Sample A11's melt flow rate, Petitioner contends that the skilled artisan would have been motivated to increase the melt flow rate from 24 g/10 min to be within the claimed range. Pet. 53–55. Specifically, Petitioner points to Kaulbach's general teaching that the "copolymers should have [a melt flow rate][9] of 15 g/10 min or higher," and that Kaulbach provides no upper limit on what the melt flow rate should be. *Id.* at 54. Thus, Petitioner asserts that Kaulbach's range completely encompasses the claimed range. Further, Petitioner avers that "[i]t was well known at the time of the '431 patent that the higher the [melt flow rate] of the FEP-copolymer, the higher the speeds at which the copolymer can be processed." *Id.* (citing Ex. 1002 ¶ 201; Ex. 1008, 2:51–53). Thus, Petitioner contends that the skilled artisan would have found it obvious to modify Sample A11 accordingly. *Id.* at 54–55.

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[9] The disclosure to which Petitioner refers discusses a melt flow index or MFI value. Ex. 1008, 1:40–41, 3:43–44. Patent Owner does not dispute that a "melt flow index" is any different than the recited "melt flow rate." Rather, Patent Owner appears to acknowledge that these terms may be used interchangeably. *See* Prelim. Resp. 24–25 (referring to Kaulbach's MFI as "a broad, open-ended MFR range of 15 g/10 min or higher"). For purposes of this Decision, we assume that the recited "melt flow rate" and Kaulbach's "melt flow index" are interchangeable phrases describing the same parameter.

Patent Owner argues that Kaulbach suggests that a copolymer with a melt flow rate of 24 g/10 min is the preferred embodiment, and the melt flow rates for Kaulbach's sample polymers range from 20–24 g/10 min. Prelim. Resp. 24–25. Patent Owner also contends that the skilled artisan would not have been motivated to adjust the melt flow rate based on the knowledge in the art "that higher [melt flow rate] leads to higher processing speeds and that [melt flow rates] of 30 g/10 min or greater reduce melt fracture," because Kaulbach tries to solve such issues in a different way—i.e., "through a narrow molecular weight distribution." *Id.* at 25.

For several reasons, we agree that Petitioner has established a reasonable likelihood that claims 3 and 4 are obvious in view of Kaulbach.

We note that Kaulbach's disclosure of a melt flow rate of greater than or equal to 15 g/10 min[10] fully encompasses the recited range of 30±3 g/10 min. In such circumstances, the narrower range may be obvious, because "[s]electing a narrow range from *within* a somewhat broader range disclosed in a prior art reference is no less obvious than *Id*entifying a range that simply overlaps a disclosed range. In fact, when, as here, the claimed ranges are completely encompassed by the prior art, the conclusion is even more compelling than in cases of mere overlap." I*n re*

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[10] We note this disclosure of Kaulbach does not expressly recite the MFI units. Ex. 1008, 3:43–44. Because Patent Owner does not allege otherwise, but rather appears to concede the units are "g/10 min" (Prelim. Res. 24), we assume for purposes of this Decision that Kaulbach's disclosure of "≥15" is a disclosure of "greater than or equal to 15 g/10 min.")

Peterson, 315 F.3d 1325, 1329–30 (Fed. Cir. 2003) (citation omitted). We also note that Kaulbach's disclosure is not limited to its preferred embodiments. *Fritch*, 972 F.2d at 1264. Thus, the melt flow rate of Sample A11, i.e., 24 g/10 min, does not negate Kaulbach's general teaching that "[f]or high speed wire extrusion the [melt flow rate] of the polymer is ≥15 [g/10 min]." Ex. 1009, 3:43–44.

We also are not persuaded, on this record, by Patent Owner's argument that because Kaulbach attempts to achieve "high processing rates" in a different way, the skilled artisan would not have considered Kono's technique for increasing the speed of wire coating extrusion process. Prelim. Resp. 25. Rather, we note that "if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007).

Therefore, based on the current record, we agree that Petitioner has established a reasonable likelihood that claims 3 and 4 are obvious in view of Kaulbach.

III. CONCLUSION

For the foregoing reasons, we are persuaded that the Petition establishes a reasonable likelihood that Petitioner would prevail on its challenge to claims 3 and 4 of the '431 patent.

As discussed above, we question the sufficiency of Petitioner's contentions with respect to certain grounds, but nevertheless institute an *inter partes* review of claims 3 and 4 on all asserted grounds. Although we exercise our discretion and institute review, we remind the parties that we have not yet made a final determination as to the patentability of any of the challenged claims.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review is hereby instituted as to claims 3 and 4 of the ’431 patent with respect to the grounds set forth in the Petition; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial commencing on the entry date of this decision.

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