United States Court of Appeals for the Federal Circuit

WELLMAN, INC.,
Plaintiff-Appellant,

v.

EASTMAN CHEMICAL COMPANY,
Defendant-Appellee.

2010-1249

Appeal from the United States District Court for the District of Delaware in Case No. 07-CV-0585, Judge Sue L. Robinson.

Decided: April 29, 2011

BARBARA L. MOORE, Edward Angell Palmer & Dodge LLP, of Stamford, Connecticut, argued for plaintiff-appellant. With her on the brief was SCOTT D. WOFSY, BARRY KRAMER, and BRIAN R. POLLACK; DENISE SEASTONE KRAFT, JOHN REED and ALEINE PORTERFIELD, of Wilmington, Delaware.

KENNETH R. ADAMO, Jones Day, Cleveland, Ohio, of argued for defendant-appellee. With him on the brief were REGAN J. FAY, THOMAS R. GOOTS, LEOZINO AGOZZINO, ANTHONY T. JACONO and PETER D. SIDDOWAY; and

LAWRENCE D. ROSENBERG, of Washington, DC. Of counsel on the brief was MARY B. GRAHAM, Morris, Nichols, Arsht & Tunnell, of Wilmington, Delaware.

Before RADER, *Chief Judge*, LOURIE, *Circuit Judge*, and WHYTE, *District Judge*.[1]

RADER, *Chief Judge*.

The United States District Court for the District of Delaware granted Eastman Chemical Company's ("Eastman's") motion for summary judgment of invalidity of U.S. Patent Nos. 7,129,317 (the "'317 patent") and 7,094,863 (the "'863 patent") (collectively, the "Wellman patents") for indefiniteness and granted-in-part Eastman's motion for summary judgment of invalidity for failure to disclose the best mode. Because the specifications of the Wellman patents do not set forth the best mode of carrying out the invention contemplated by at least one of the inventors, this court affirms the district court's judgment with respect to best mode. Because a person of ordinary skill could understand the bounds of the patent claims, however, this court reverses the district court's judgment with respect to indefiniteness.

I

The Wellman patents disclose polyethylene terephthalate ("PET") resins for use in plastic beverage containers. The patents claim priority to the same applications and share similar specifications. The patents state that prior art PET resins produced bottles that shrank or grew hazy from crystallization when "hot-filled" with product at

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[1] The Honorable Ronald M. Whyte, United States District Court for the Northern District of California, sitting by designation.

temperatures of between about 180° C and 205° C. '317 patent col.2 ll.1-9; '863 patent col.2 ll.9-17. To overcome these problems, the Wellman patents disclose "slow-crystallizing" PET resins that purportedly retain exceptional clarity by delaying the onset of crystallization relative to conventional PET resins. '317 patent col.3 ll.15-25; '863 patent col.3 ll.25-35. The disclosed resins also purportedly reduce haze formed during the production process. '317 patent col.8 ll.39-47; '863 patent col.3 ll.46-54.

The Wellman patents define "slow-crystallizing" PET resins as those possessing a significantly higher heating crystallization exotherm peak temperature (T_{CH}) as compared with conventional PET resins, which use the metallic element antimony as a catalyst. '317 patent col.3 ll.16-20; '863 patent col.3 ll.25-30. T_{CH} is the temperature at which the sample crystallizes the fastest during heating in a differential scanning calorimetry ("DSC") machine. '317 patent col.7 ll.55-58, col.8 ll.48-53; '863 patent col.7 ll.62-65, col.8 ll.55-65. Thus, Figure 1 of each patent shows a slow-crystallizing, titanium-catalyzed PET resin with a T_{CH} of 144.2°C. By comparison, Figure 3 shows a conventional antimony-catalyzed PET resin with a T_{CH} of 130.6°C. '317 patent col.8 ll.7-22; '863 patent col.8 ll.14-29.

By the time Wellman filed the application leading to the '317 patent in May 2004, it had commercialized a slow-crystallizing, hot-fill PET resin called Ti818. According to Dr. Steven Nichols, an inventor of the Wellman patents, Ti818 had the following composition as of May 2004:

Parameter	Amount
Isophthalic Acid	1.4 mol %
Diethylene Glycol	1.9 mol %
Trimellitic Anhydride ("TMA")	500 ppm
Carbon-Black reheat agent	7.5 ppm
Elemental Cobalt	30 ppm
Titanium-based catalyst	7 ppm (Ti)
Phosphorus	5 ppm
Potassium	25 ppm

Wellman did not disclose the recipe for Ti818 in its patents. Nor did Wellman disclose any other specific PET resin recipes. Instead, Wellman provided ranges of concentrations for categorized lists of possible ingredients. For example, the patents identify a preferred range of isophthalic acid, a raw ingredient used to synthesize PET, of between about 1.6 and 2.4 mole percent. '317 patent col.20 l.65-col.21 l.2; '863 patent col.22 ll.30-34. Ti818 contained 1.4 mole percent isophthalic acid. Similarly, the Wellman patents identify a preferred concentration of 1.6 mole percent for diethylene glycol, another raw ingredient used to synthesize PET. '317 patent col.20 l.65-col.21 l.2; '863 patent col.22 ll.30-34. Ti818 contained 1.9 mole percent diethylene glycol.

The Wellman patents disclose optional heat-up rate ("HUR") additives for the PET resin that improve the resin's reheating profile during bottle blow molding. '317 patent col.10 ll.16-26; '863 patent col.11 ll.38-49. The

patents state that "natural spinels and synthetic spinels" are the "most preferred" HUR additives. '317 patent col.11 ll.42-43; '863 patent col.12 ll.64-65. Copper chromite black spinel and chrome iron nickel black spinel are characterized as "[p]articularly outstanding spinel pigments." '317 patent col.11 ll.42-47; '863 patent col.13 ll.1-2. In contrast, the Wellman patents describe carbon-based HUR additives as "one embodiment" of the invention. '317 patent col.11 ll.1-2; '863 patent col.12 ll.23-24. The patents state that "suitable" carbon-based additives include carbon black, and note that U.S. Patent No. 4,408,004 ("Pengilly") discloses "satisfactory" carbon black HUR additives. '317 patent col.11 ll.8-12; '863 patent col.12 ll.30-34. Pengilly discloses a preferred average particle size for carbon black in a range of between about 15 to about 30 nm. Pengilly col.4 ll.21-22. Wellman's Ti818 recipe includes a HUR additive called N990, which is a specific type of carbon black with a 290 nm particle size.

Notably, two provisional applications in the chain of applications leading to the Wellman patents, respectively filed May 21, 2003 and April 6, 2004, characterize carbon-based HUR additives as "preferabl[e]" and copper chromite spinels as "suitable." On May 20, 2004, the day before Wellman filed the nonprovisional application leading to the '317 patent, Wellman filed a third provisional application changing its preference from a carbon-based HUR to a spinel.

Claim 1 of the '317 patent is representative of the asserted claims and states as follows:

> 1. A polyethylene terephthalate resin, comprising:
> less than about 25 ppm of elemental antimony, if any; and

> more than about 5 ppm of elemental phosphorus; and
>
> *wherein the polyethylene terephthalate resin has a heating crystallization exotherm peak temperature (T_{CH}) of more than about 140° C. at a heating rate of 10° C. per minute as measured by differential scanning calorimetry*;
>
> wherein the polyethylene terephthalate resin has an absorbance (A) of at least about 0.18 cm^{-1} at a wavelength of 1100 nm or at a wavelength of 1280 nm; and
>
> wherein the polyethylene terephthalate resin has an L* luminosity value of more than about 70 as classified in the CIE L*a*b* color space.

'317 patent col.26 ll.9-23 (emphasis added). All of the asserted claims include T_{CH} limitations.

Wellman alleges that Eastman directly infringes claims 1-5, 7, 8, 11-14, 16-21, 24, 32, 33, 36, 38, 39, 44, 93, 94, 96-102, and 104 of the '317 patent. Wellman further alleges that Eastman indirectly infringes claims 1, 3-6, 8, 9, 11, 15, 17, 24, and 62 of the '863 patent.

On August 14, 2009, Eastman moved for summary judgment of invalidity on the grounds of indefiniteness and failure to set forth the best mode of practicing the claimed invention. The district court granted-in-part Eastman's best mode summary judgment motion, holding invalid all of the asserted claims except dependent claims 5, 17, and 94 of the '317 patent and claims 6 and 9 of the '863 patent—the five claims that Wellman contends do not encompass Ti818. *Wellman, Inc. v. Eastman Chem. Co.*, 689 F. Supp. 2d 705, 712, 716 (D. Del. 2010).

The district court found that at least inventor Dr. Nichols viewed Ti818 as the best mode of practicing the invention at the time of filing. The district court also found that inventor David Thompson preferred carbon black N990 as the HUR additive for practicing the invention. *Id*. at 715-16. The court further found that the Wellman patents do not disclose Ti818 sufficiently to enable one of ordinary skill in the art to identify it. *Id*. The court emphasized that the Wellman patents do not disclose either the formula or tradename of Ti818, even though it was Wellman's operative PET resin formula at the time of filing its patents. *Id*. The district court acknowledged that the disclosure of ranges of ingredients encompassing the best mode can satisfy the best mode requirement, but found that the patents disguise Ti818 by disclosing "preferred" ranges for certain ingredients that do not encompass the actual concentrations of those ingredients in the Ti818 formula. *Id*. at 714-15.

Additionally, the district court found that the Wellman patents do not disclose the use of carbon black N990. *Id*. at 715. Based on testimony of inventor Thompson and his supervisor James Bruening, the court found that Wellman instead sought to maintain the use of N990 as a trade secret. *Id*. at 710, 715-16. The district court therefore granted-in-part Eastman's motion for summary judgment for failure to disclose the best mode as required by 35 U.S.C. § 112 ¶ 1, invalidating the asserted claims of the '317 and '863 patents except for the five dependent claims that Wellman argued do not encompass Ti818. *Id*. at 721.

The district court also granted Eastman's motion for summary judgment of invalidity for indefiniteness. *Id*. at 720-21. Although all of the claims asserted by Wellman contain a limitation to a PET resin having a certain T_{CH} as measured by DSC, the district court found that the

Wellman patents do not disclose sample conditions and testing parameters essential for obtaining consistent DSC measurements. *Id*. at 717, 720. In particular, the district court found that the patents do not disclose or suggest the desired moisture content for the claimed PET resins, even though variations in moisture content can affect T_{CH} measurements. *Id*. The district court also found that the Wellman patents are ambiguous as to whether the DSC measurement should be determined via a second scan (which erases the thermal history of the sample prior to measurement) or a first scan (which does not). *Id*. Thermal history, like moisture content, can affect T_{CH} measurements. Given these "multitude of choices," the district court found that the T_{CH} limitations in the asserted claims were not amenable to construction, rendering all of the asserted claims invalid as indefinite under 35 U.S.C. § 112 ¶ 2. *Id*. at 719-20.

Wellman appeals the grants of summary judgment. This court has jurisdiction pursuant to 28 U.S.C. § 1295(a)(1).

II

This court reviews a grant of summary judgment without deference. *Dynacore Holdings Corp. v. U.S. Philips Corp.,* 363 F.3d 1263, 1273 (Fed. Cir. 2004). Summary judgment is appropriate if the movant can show both the absence of genuine issues of material fact and entitlement to judgment as a matter of law. Fed. R. Civ. P. 56(c). This court reviews the evidence in the light most favorable to the non-moving party. *Anderson v. Liberty Lobby, Inc*., 477 U.S. 242, 255 (1986).

III

A patent specification "shall set forth the best mode contemplated by the inventor of carrying out his inven-

tion." 35 U.S.C. § 112 ¶ 1. The best mode inquiry proceeds on a claim by claim basis. *Pfizer, Inc. v. Teva Pharms. USA, Inc.*, 518 F.3d 1353, 1365 (Fed. Cir. 2008). "Best mode issues can arise if any inventor fails to disclose the best mode known to him or her" as of the date the application for patent is filed. *Pannu v. Iolab Corp.*, 155 F.3d 1344, 1351 n.5 (Fed. Cir. 1998). "The best mode requirement creates a statutory bargained-for-exchange by which a patentee obtains the right to exclude others from practicing the claimed invention for a certain time period, and the public receives knowledge of the preferred embodiments for practicing the claimed invention." *Eli Lilly & Co. v. Barr Labs., Inc.*, 251 F.3d 955, 963 (Fed. Cir. 2001). "A violation of the best mode requirement must be proved by clear and convincing evidence." *All-Voice Computing PLC v. Nuance Commc'ns, Inc.*, 504 F.3d 1236, 1240 (Fed. Cir. 2007).

The best mode requirement has two parts. *Green Edge Enters., LLC v. Rubber Mulch Etc., LLC*, 620 F.3d 1287, 1296 (Fed. Cir. 2010). First, the court must determine whether, at the time of patent filing, the inventor possessed a best mode of practicing the claimed invention. *Id.* (citing *U.S. Gypsum Co. v. Nat'l Gypsum Co.*, 74 F.3d 1209, 1212 (Fed. Cir. 1996)). This first prong is subjective, focusing on the inventor's personal preferences as of the application's filing date. *N. Telecom Ltd. v. Samsung Elecs. Co.*, 215 F.3d 1281, 1286 (Fed. Cir. 2000). Second, if the inventor has a subjective preference for one mode over all others, the court must then determine whether the inventor "concealed" the preferred mode from the public. *Green Edge*, 620 F.3d at 1296 (quoting *Chemcast Corp. v. Arco Indus. Corp.*, 913 F.2d 923, 928 (Fed. Cir. 1990)). The second prong inquires into the inventor's disclosure of the best mode and the adequacy of that disclosure to enable one of ordinary skill in the art to

practice that part of the invention. *Id.* This second inquiry is objective, depending on the scope of the claimed invention and the level of skill in the relevant art. *Id.*

At the outset, this court notes that the district court did not construe the claims before engaging in the best mode inquiry. This court has explained that "[t]he best mode inquiry is directed to what the applicant regards as the invention, which in turn is measured by the claims." *Engel Indus., Inc. v. Lockformer Co.*, 946 F.2d 1528, 1531 (Fed. Cir. 1991). Because "[s]ubject matter outside the scope of the claims falls outside of the best mode requirement," a "threshold step in a best mode inquiry is to define the invention by construing the claims." *Ajinomoto Co., Inc. v. Int'l Trade Comm'n*, 597 F.3d 1267, 1272-73 (Fed. Cir. 2010).

While the best mode inquiry typically requires a claim construction, claim terms need only be construed "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). In this case, the parties dispute only whether claims 5, 17, and 94 of the '317 patent and claims 6 and 9 of the '863 patent encompass Ti818—the parties agree that the remaining asserted claims encompass Ti818. Because the district court limited its best mode holding to the uncontroverted claims, *Wellman*, 689 F. Supp. 2d at 713, the district court had no need to construe the disputed terms. *See, e.g.*, *EMI Grp. N. Am., Inc. v. Intel Corp.*, 157 F.3d 887, 895 (Fed. Cir. 1998) (holding that the construction of a given claim term was "irrelevant" because it did not affect the underlying controversy between the parties). In these unusual circumstances, this court detects no need for a claim construction prior to engaging in the best mode inquiry.

This court turns next to the first prong of the test for best mode. There is no genuine dispute that at least one inventor subjectively believed that Ti818—which contains carbon black N990—was the best resin available for hot-fill packaging at the time of filing the applications for the '317 and '863 patents. Specifically, Dr. Nichols testified that his preferred PET recipe at the time of filing was "the first run of the product that we called Ti818 which was done at our Pearl River plant in the fall of 2003." J.A. 297 11:11-24. Nichols further admitted that, before filing, he believed there was no PET recipe better than that Ti818 recipe from 2003. J.A. 300 23:21-24:9. Another inventor, Dr. Tony Moore, also appears to have believed that Ti818 was the preferred PET resin. Although he did not refer to Ti818 by name, he testified that as of the filing date of the '317 patent, the best way of making PET in the research laboratory to achieve the claimed T_{CH}, absorbance, and luminosity values used a combination of titanium catalysts, cobalt, and carbon black as the HUR additive. Ti818 contains each of these ingredients.

Although the record shows that Dr. Nichols preferred the 2003 recipe of Ti818, the district court found that Dr. Nichols believed that the 2004 recipe of Ti818 was the best mode of practicing the invention. *Wellman*, 689 F. Supp. 2d at 713. This harmless misstatement does not rescue the relevant claims from a best mode violation. Rather than a nullifying conflict, this only shows that Dr. Nichols had an obligation to disclose the recipe he believed to be the best mode at the time of patent filing—the 2003 recipe. The applicant did not do so. *See Dana Corp. v. IPC Ltd. P'ship*, 860 F.2d 415, 418 (Fed. Cir. 1988) (requiring disclosure of the best mode contemplated by the inventor at the time of filing).

The district court also suggested that the record did not show a changed recipe for Ti818 between 2003 and 2004. *See Wellman*, 689 F. Supp. 2d at 709 n.4. However, Wellman's declarations of record indicate that in early 2004, the concentration of carbon black was reduced from 11.3 ppm to 7.5 ppm and the branching agent TMA was included, purportedly to accommodate specific customer requirements. Additionally, the record includes declarations from two of the inventors (belatedly submitted *after* the best mode oral arguments but prior to entry of summary judgment) contending that at least four different recipes of Ti818, each with differing concentrations of carbon black, underwent testing leading up to May 2004. Dr. Nichols also testified that the inventors had made numerous samples and declared he was unsure whether Wellman had a single preferred resin.

On summary judgment, this court must resolve factual inferences in favor of the non-movant. *Anderson*, 477 U.S. at 255. In this context, an evolving recipe potentially means that the inventors had no best mode of practicing the invention. *See Bruning v. Hirose*, 161 F.3d 681, 687 (Fed. Cir. 1998) (finding inventor had no best mode because of concern about certain characteristics of his invention). However, even when viewed in the light most favorable to Wellman, this evidence cannot overcome the testimony of the inventors, including Dr. Nichols' testimony regarding his subjective belief that the 2003 recipe of Ti818 was the best method of practicing the invention at the time of filing. Put simply, at the time of filing, an inventor believed that the 2003 recipe of Ti818 was the best mode. Subtle changes in the recipe in 2004 to accommodate specific customer demands does not excuse the applicant's obligation to disclose what Dr. Nichols—and every other inventor—contemplated was the best mode of practicing the invention at the time of filing. The

district court's assessment of changes in the Ti818 recipe therefore does not affect substantial rights of the parties and was at most harmless error.

There is no genuine dispute that at least one inventor subjectively believed that the specific HUR additive used in Ti818, carbon black with a 290 nm particle size, was essential. In October 2002, after testing a variety of HUR additives, inventor Thompson wrote that "carbon black with a 290 nm particle size had *clearly the best reheat rate* . . . ." J.A. 436 (emphasis added). Thompson characterized carbon black with a 290 nm particle size as an "invention," while characterizing the other tested HURs as "prior art." J.A. 437. Additionally, a table comparing tests on various HUR additives states that "7.5 ppm code 5056" is the "*HUR Needed for hotfill*," while the spinel Cr_2O_3 is described as "Green." J.A. 439 (emphasis added). "Code 5056" is Wellman's internal name for carbon black with a 290 nm particle size, indicating a clear preference for this HUR. Notably, inventor Dr. Moore forwarded this table to Wellman's patent counsel less than two months before Wellman filed the application leading to the '317 patent.

Wellman did not disclose carbon black N990 in its patent applications. Instead, Wellman chose to protect this ingredient of Ti818 as a trade secret. Thompson testified that his boss, James Bruening, instructed him to maintain carbon black N990 as a trade secret:

> Q. Was Wellman trying to keep N990 as a trade secret?
> . . .
> A. Yes.
> . . .

> Q. And were you instructed by anybody at Wellman on maintaining the trade secret nature of N990?
> A. Yes.
> Q. Who?
> A. Mr. Bruening.

J.A. 357 71:18-72:6. Bruening acknowledged that he instructed his department to maintain N990 as a trade secret. Wellman continued to protect the use of N990 in its PET resin products as a trade secret from its discovery in 2002 through February of 2010. Indeed, Wellman requested that the district court seal the courtroom during the arguments on summary judgment expressly to maintain the confidentiality of N990.

Notwithstanding the admissions in Wellman's internal documents, the use of carbon black N990 in Wellman's commercial product, and the mandate to maintain N990 as a trade secret, Wellman argues that experimental work performed by Dr. Moore shortly before May 2004 creates a genuine dispute of material fact as to whether the inventors believed that carbon black N990 was the most preferred HUR additive as of the time of filing. Additional disclosure in Wellman's non-provisional application purportedly shows that spinels displayed superior absorption selectivity to unenhanced PET. Furthermore, a declaration of Dr. Moore, submitted after the hearing on summary judgment, states that his absorption data shows that PET using a spinel reheat agent has superior color characteristics than PET using carbon black.

These arguments have both procedural and substantive shortcomings on appeal. As to the procedural deficiencies, Wellman did not raise the significance of the additional disclosure concerning absorption ratios in its best mode briefing or oral arguments before the district

court. Wellman also did not explain this disclosure's connection to the alleged preference for spinels. This court looks to the law of its sister circuit, the United States Court of Appeals for the Third Circuit, to determine the implications of these deficiencies. *In re Cygnus Telecomm. Tech., LLC, Patent Litig.*, 536 F.3d 1343, 1351-52 (Fed. Cir. 2008). Third Circuit law holds that in challenging a summary judgment order on appeal, a party cannot "advance new theories or raise new issues in order to secure a reversal of the lower court's determination." *Union Pac. R.R. Co. v. Greentree Transp. Trucking Co.*, 293 F.3d 120, 126 (3d Cir. 2002). Wellman has therefore forfeited its right to argue the significance of these absorption ratios on appeal.

Even without this procedural obstacle, these contentions do not create a genuine issue of material fact for the best mode inquiry. The disclosure added to the nonprovisional application does not suggest a new-found preference for spinels relative to carbon black N990, because the additional disclosure does not compare PET recipes containing spinels to those containing carbon black N990. Instead, it compares PET resins containing spinels to those without a HUR additive. '317 patent col.16 ll.4-9; '863 patent col.17 ll.35-40. Moreover, while Dr. Moore's belatedly filed declaration states that he believes spinels would produce "better color characteristics" than PET using thermal carbon black, he testified that as of filing date of the '317 patent, he preferred using carbon black as the best way of making PET to achieve the claimed T_{CH}, absorbance, and luminosity values.

Significantly, Dr. Nichols also testified that a recipe containing carbon black was his preferred PET resin prior to patent filing. In contrast, no inventor identified a PET resin containing a spinel as a preferred embodiment of the invention. Wellman's contemporaneous internal

documents also undermine these arguments, as they praise carbon black N990 as "clearly the best" and as the HUR "[n]eeded for hotfill." J.A. 436; J.A. 439. No contemporaneous document in the record similarly praises spinels.

Wellman contends that one of its inventors, Dr. Robert Schiavone, believed that tungsten-based HUR additives were preferred over all others, at least prior to the absorption ratio research disclosed in the nonprovisional application purportedly showing the superiority of spinels. Dr. Schiavone did not state or suggest that any other inventor shared this view. Additionally, Wellman represented to the district court that Dr. Schiavone continues "to this very day" to view tungsten-based reheat agents as superior to spinels—further undermining its theory that the additional disclosure in the nonprovisional application demonstrated a new-found preference for spinels.

Wellman's patent attorney testified that Wellman would have revised its commercial PET resins to include spinels instead of carbon black N990, but for concerns over a third-party patent. A party's failure to disclose its commercial mode does not ipso facto result in a § 112 violation because the focus of a best mode inquiry remains on the claimed invention rather than the marketed product. *Zygo Corp. v. Wyko Corp.*, 79 F.3d 1563, 1567 (Fed. Cir. 1996). In this case, however, Wellman concedes that its commercial Ti818 PET resin is within the scope of the claims invalidated by the district court. Coupled with the additional evidence set forth above, this court concludes that Ti818 and its HUR additive carbon black N990 were considered the best mode of practicing the invention by one or more inventors at the date of filing.

With a record showing that at least one inventor possessed a subjective preference for Ti818 and at least one inventor possessed a subjective preference for N990, this court must determine whether there is any issue of material fact concerning concealment of the best mode, the second prong of the best mode inquiry. *Go Medical Indus. Pty., Ltd. v. Inmed Corp.*, 471 F.3d 1264, 1271 (Fed. Cir. 2006). The Wellman patents do not expressly disclose the Ti818 recipe, but instead describe many possible ingredients with varied ranges of concentrations. While an inventor may represent his contemplated best mode just as well by a preferred range of conditions as by a working example, *In re Honn*, 364 F.2d 454, 462 (CCPA 1966), some of the ingredients for Ti818, namely isophthalic acid and diethylene glycol, fall *outside* of the disclosed preferred ranges and therefore lead away from the Ti818 recipe.

The Wellman patents lead away from the use of carbon black N990 in Ti818. Specifically, the patents characterize carbon black merely as a "suitable" HUR additive without any discussion of particle sizes. The Pengilly patent, the sole source of carbon black HUR additives identified in the Wellman patents, states that carbon black HUR additives have "typical" particle sizes "from 10 to 100 nm" and "preferred" average particle sizes from "about 15 to about 30 [nm]." '317 patent col.11 ll.10-12; Pengilly col.2 ll.54-60, col.4 ll.18-24. Carbon black N990 has a particle size of 290 nm. While there is no requirement under 35 U.S.C. § 112 ¶ 1 to identify which disclosed mode is the best mode, *In re Bosy*, 360 F.2d 972, 976 (CCPA 1962), and best mode may be represented by a preferred range of conditions or group of ingredients, *Honn*, 364 F.2d at 462, Wellman concealed the best mode by not disclosing the recipe for Ti818, by identifying preferred concentration ranges for certain ingredients

that excluded those used in Ti818, and by identifying preferred particles sizes for the HUR additive other than that used in Ti818.

Despite these facts of record, this court goes on to examine Wellman's disclosure to discern whether it enabled a person of skill in the art to practice the best mode without undue experimentation. Dr. Schiavone, a named inventor, admitted he could not derive the recipe for Ti818 from the disclosure in the Wellman patents. Dr. Nichols, another inventor, testified that a series of design experiments could be developed to identify a resin meeting the claimed limitations, but did not state that those experiments would yield Ti818. Moreover, "[e]ven where there is a general reference to practicing the claimed invention, the quality of the disclosure may be so poor as to effectively conceal it." *Transco Prods. Inc. v. Performance Contracting, Inc.*, 38 F.3d 551, 560 (Fed. Cir. 1994) (citing *Randomex Inc. v. Scopus Corp.*, 849 F.2d 585, 587 (Fed. Cir. 1988)). By masking what at least one inventor considered the best of these slow-crystallizing resins, Wellman effectively concealed its recipe for Ti818. Wellman admittedly spent millions of dollars and thousands of hours developing its claimed slow-crystallizing PET resins. Dr. Nichols declared that the inventors "unlocked in our research . . . the secret to making an effective slow-crystallizing bottle resin by understanding the proper balance of the parameters of catalyst concentration, comonomer concentration, intrinsic viscosity, and heat-up-rate [HUR] additive in order to make high clarity bottles." J.A. 5117. Wellman had an obligation to adequately disclose the best mode of practicing this "unlocked secret" under the best mode requirement, yet did not do so.

The record also shows that Wellman intentionally concealed the best mode. "Invalidation based on a best

mode violation requires that the inventor knew of and intentionally concealed a better mode than was disclosed." *High Concrete Structures, Inc. v. New Enter. Stone & Lime Co.*, 377 F.3d 1379, 1384 (Fed. Cir. 2004). As shown by the testimony of Thompson and Bruening, Wellman intended to conceal carbon black N990, an ingredient in Ti818, by choosing to maintain it as a trade secret. As the district court correctly stated, this choice "does not excuse Wellman's compliance with the best mode requirement." *Wellman*, 689 F. Supp. 2d. at 716. Accordingly, this court affirms the invalidity of claims 1-4, 7, 8, 11-14, 16, 18-21, 24, 32, 33, 36, 38, 39, 44, 93, 96-102, and 104 of the '317 patent and claims 1, 3-5, 8, 11, 15, 17, 24 and 62 of the '863 patent for failure to comply with the best mode requirement.

The district court correctly declined to invalidate the remaining asserted claims. *Id*. at 712-13. Despite having the burden of proof, Eastman offered no affirmative evidence that Ti818 is encompassed by these claims. Eastman contends that Dr. Nichols and Wellman's expert, Dr. David Schiraldi, admitted that Ti818 and N990 satisfy the T_{CH}, absorbance, and L* limitations of these additional claims. Because these terms are contested, have not been construed, and are essential to resolving the controversy over best mode, Eastman's position is untenable. Additionally, the alleged admissions do not address the cooling crystallization exotherm peak temperature (T_{CC}) term recited in claim 17 of the '317 patent. Thus, this court perceives that the trial court gave the proper consideration and weight to this evidence. This court therefore declines to extend the holding of invalidity on best mode grounds beyond those claims invalidated by the district court.

IV

"The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention." 35 U.S.C. § 112 ¶ 2. "The review of indefiniteness under 35 U.S.C. § 112, paragraph 2, proceeds as a question of law without deference." *SmithKline Beecham Corp. v. Apotex Corp.*, 403 F.3d 1331, 1338 (Fed. Cir. 2005). "The question of whether the claims meet the statutory requirements of § 112 ¶ 2 is a matter of construction of the claims, and receives plenary review on appeal. . . . The claims as granted are accompanied by a presumption of validity based on compliance with, *inter alia*, § 112 ¶ 2." *S3 Inc. v. NVIDIA Corp.*, 259 F.3d 1364, 1367 (Fed. Cir. 2001) (citations omitted).

Claims need not be plain on their face in order to avoid condemnation for indefiniteness; rather, claims must only be amenable to construction. *Exxon Research & Eng'g Co. v. United States*, 265 F.3d 1371, 1375 (Fed. Cir. 2001). "[B]ecause claim construction frequently poses difficult questions over which reasonable minds may disagree, proof of indefiniteness must meet 'an exacting standard.'" *Haemonetics Corp. v. Baxter Healthcare Corp.*, 607 F.3d 776, 783 (Fed. Cir. 2010) (quoting *Halliburton Energy Servs., Inc. v. M-I LLC*, 514 F.3d 1244, 1249 (Fed. Cir. 2008)). Thus, "[a]n accused infringer must . . . demonstrate by clear and convincing evidence that one of ordinary skill in the relevant art could not discern the boundaries of the claim based on the claim language, the specification, the prosecution history, and the knowledge in the relevant art." *Id.* "By finding claims indefinite only if reasonable efforts at claim construction prove futile, we accord respect to the statutory presumption of patent validity . . . and we protect the inventive contribution of patentees, even when the draft-

ing of their patents has been less than ideal." *Exxon*, 265 F.3d at 1375 (citation omitted).

The district court erred in concluding that the Wellman patents do not provide sufficient guidance for construing the T_{CH} claim term. The patents support a construction that limits the claimed T_{CH} measurement to those occurring on a sample of "amorphous" PET material. "[C]laims 'must be read in view of the specification, of which they are a part.'" *Phillips v. AWH Corp.*, 415 F.3d 1303, 1315 (Fed. Cir. 2005) (en banc) (quoting *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 979 (Fed. Cir. 1995) (en banc)). "[T]he specification 'is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term.'" *Id.* (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)).

The specifications of the Wellman patents support construing the T_{CH} term to require testing of amorphous materials. Every example of DSC testing in the patents features amorphous materials, with "FIGS. 1, 3, 5, and 7 correspond[ing] to the heating of amorphous polymer and FIGS. 2, 4, 6, and 8 correspond[ing] to the cooling of the same polymer from the melt phase." '317 patent col.8 ll.4-6; '863 patent col.8 ll.11-13. The patents expressly state that "[t]hose having ordinary skill in the art will recognize that heating crystallization exotherm peak temperature (T_{CH}) is determined on a non-crystalline [PET] resin." '317 patent col.8 ll.55-58; '863 patent col.8 ll.62-65. Eastman's expert, Dr. Donna Quillen, confirmed that "there's no crystallinity" in an amorphous material. J.A. 7552 21:13-19. Additionally, the Wellman patents specifically disclose a four-step DSC protocol useful for measuring T_{CH} on amorphous materials. '317 patent, col.7 l.64-col.8 l.4; J.A. 7054; J.A. 7071. Interpreted in light of the speci-

fication, the claimed T_{CH} measurement occurs on amorphous PET material.

Chef America Inc. v. Lamb Weston, Inc., 358 F.3d 1371, 1374 (Fed. Cir. 2004), among other cases, prohibits courts from rewriting claims instead of interpreting the claims as written. In *Chef America*, the court refused to redraft the claims to replace the term "to" with the term "at," even though that refusal produced a nonsensical result. *Id.* Unlike in *Chef America*, however, construing the claim to require testing on an "amorphous PET material" does not replace any claim term with a different term, but instead interprets the claimed DSC measuring technique in light of the specifications, which clearly, repeatedly, and unambiguously state that such tests should be performed on amorphous PET material.

Claim terms must provide a discernible boundary between what is claimed and what is not claimed—in this case, between an amorphous PET material and a crystalline material. Consistent with this, the Wellman patents twice state that an amorphous material has "less than about 4 percent crystallinity." '317 patent col.12 ll.48-50, col.23 l.67-col.24 l.4. Wellman's expert, Dr. David Schiraldi, testified that "less than four percent crystallinity would typically be referred to as an amorphous PET [material] by people in the PET industry," thus supplying a link between the specification and the understanding in this field. J.A. 333 61:9-19. Thus, the Wellman patents define an amorphous material consistent with the teachings in this field, and a person of ordinary skill in this art could readily discern the boundary between amorphous and crystalline materials as these terms are defined in the specifications.

Eastman argues that an equation furnished by Wellman to the district court for estimating the amount of

crystallinity in test samples based on DSC scans yields crystallinity percentages above four percent for the scans shown in Figures 1, 3, 5, and 7 of the patents. The actual crystallinity present in test samples, however, can be readily determined by a person of skill in the art using standardized test methods. The equation merely provides an estimate, and may overestimate or underestimate the amount of crystallinity present in the sample prior to testing. For example, one sample tested using this formula purportedly showed negative crystallinity, which is not possible. Thus, this unpersuasive and conflicting extrinsic evidence does not override the clear description in the specification of an amorphous PET material.

In holding the claims indefinite, the district court focused on the lack of specific moisture conditions for DSC testing, reasoning that the absence of intrinsic guidance would prevent a person of ordinary skill from understanding the bounds of the claims. *Wellman*, 689 F. Supp. 2d at 719-20. However, an inventor need not explain every detail because a patent is read by those of skill in the art. *Koito Mfg. Co. v. Turn-Key-Tech, LLC*, 381 F.3d 1142, 1156 (Fed. Cir. 2004) (citing *In re Howarth*, 654 F.2d 103, 105 (CCPA 1981)). Well known industry standards need not be repeated in a patent. *See id.* In this case, the record shows that a person of ordinary skill in the art in this field would follow standard industry guidance for conditioning plastics for DSC. Specifically, the record shows that (1) the 1997 International Standard for Differential Scanning Calorimetry of Plastics ("ISO 11357-1) (the "1997 ISO") provides a person of skill in the art with an objective standard for moisture conditioning; (2) a person of skill in the art would have been aware of the 1997 ISO prior to the filing of its patent applications; and (3) a person of skill in the art would have interpreted the Wellman patents in view of the 1997 ISO.

Wellman's expert, Dr. Schiraldi, declared that a person of skill in the art would have interpreted the Wellman patents in view of the internationally recognized 1997 ISO. In a section entitled "[c]onditioning of test specimens," the 1997 ISO recommends conditioning test specimens for DSC in accordance with ISO 291, unless other conditions are specified. J.A. 7049. ISO 291, entitled "Plastics - Standard atmospheres for conditioning and testing," defines specific temperature and humidity conditions for specimen testing. *Id*. The record suggests no reason that a person of skill in the art would have been incapable of applying those moisture conditioning standards to the claimed invention to achieve consistent, repeatable T_{CH} measurements.

Wellman stated before the district court that moisture "predictably" affects T_{CH}. This simply acknowledges the well known fact within the relevant scientific community that moisture conditions can influence DSC testing—which is precisely why standard parameters are set forth in the guidance. Similarly, both parties' experts agreed that moisture conditioning affects the measured T_{CH} of PET resins within the scope of the asserted claims. However, nothing suggests that a person of skill in the art would fail to account for moisture or otherwise deviate from the standard conditions set forth in the 1997 ISO.

Eastman argues that ISO 291 should not be relied upon, because that document was allegedly not part of the summary judgment record. To the contrary, Wellman argued in its summary judgment opposition brief before the district court that the inventors need not have disclosed sample preparation details set forth in the 1997 ISO guidelines for conducting DSC tests, as these were readily available to those having ordinary skill in the art at the time the Wellman patents were filed. Wellman also included the 1997 ISO as an exhibit to its summary

judgment brief, and that document specifically references and incorporates ISO 291 as defining the atmospheric conditions for conditioning and testing DSC specimens. Because the argument was before the district court, Wellman properly refers to the industry guidance on appeal. *See Union Pacific R.R.*, 293 F.3d at 126.

The district court relied on *Honeywell International, Inc. v. International Trade Commission*, 341 F.3d 1332, 1339 (Fed. Cir. 2003), a case also involving DSC testing of PET products, but *Honeywell* is inapposite. In *Honeywell*, a person of skill in the art had to choose among four different sample preparation methods, with each method influencing whether the accused products fell within the scope of the asserted claims. *Id*. at 1336. This court concluded that the claims were insolubly ambiguous, and hence indefinite, because no intrinsic or extrinsic guidance indicated a single preferred method of sample preparation. *Id*. at 1340-41. Notably, the patentee's preferred construction in that case favored an unpublished method documented only in the patentee's proprietary files. *Id*. at 1336, 1341.

This case is very different. While the claims do not recite specific moisture conditions, the well-known practice in this field as illustrated in the 1997 ISO made this a routine concern to a person of ordinary skill in the art. This court has repeatedly stated that a patent applicant need not include in the specification that which is already known to and available to a person of ordinary skill in the art. *See, e.g.*, *Koito*, 381 F.3d at 1156. Because a person of ordinary skill in the art would have followed published industry standards, the asserted claims of the Wellman patents are not indefinite for failing to specify moisture conditions.

The district court also erred in concluding that disclosure about the thermal history of a resin is necessary to maintain the definiteness of the asserted claims. Thermal history refers to the sample's exposure to heat and stress before DSC testing. Heat and stress can cause polymeric PET strands to orient, which potentially influences T_{CH} measurements.

In this case, the patents disclose that T_{CH} is determined on "amorphous" PET materials. Within the context of the patents at issue, an "amorphous" material is in the same physical state as a material that initially had a thermal history but was then subjected to a first scan that melted the PET polymer to remove the thermal history. Thus, according to Wellman, an amorphous PET material will produce equivalent DSC results regardless of whether one uses a four-step "first scan" protocol or six-step "second scan" protocol.

The 1997 ISO recommends obtaining both a first scan and a second scan when testing polymeric materials. Because the first scan eliminates the thermal history of the polymer, it creates a common baseline for the comparison of each sample tested on a second scan. Thus, the 1997 ISO recommends that second scan results "should be used." J.A. 7054; J.A. 7071. However, it further provides that first scan results "may be taken" to evaluate the properties of "specially pre-conditioned samples." J.A. 7054; J.A. 7071. Accordingly, if a person of ordinary skill in the art knew that a resin was already amorphous by virtue of its manufacture, removing the thermal history of the sample would be unnecessary and a first scan protocol could be used. The Wellman patents make precisely that disclosure in Figures 1, 3, 5, and 7, which show DSC scans obtained using first scan protocols on amorphous materials. '317 patent col.7 l.64-col.8 l.6; '863 patent col.8 ll.4-13. However, if the amorphous material

had been subjected to heat or stress, then a person of ordinary skill in the art would use second scan results in accordance with the 1997 ISO to remove the potential influence of that thermal history.

Eastman nevertheless argues that disclosure about thermal history is important, because some Wellman internal documents and prior art of record show that amorphous PET materials can have orientation. As a preliminary matter, this argument conflicts with the testimony of Eastman's expert, Dr. Quillen, who stated that "[i]n an amorphous polymer, the chains are not oriented." J.A. 8756 21:13-32. More fundamentally, if an amorphous PET material had some orientation due to its thermal history, a person of skill in the art would know to use second scan results to resolve the concern in accordance with industry practice. This court therefore reverses the district court's judgment with respect to indefiniteness.

V

For the foregoing reasons, this court affirms the district court's summary judgment holding that all but five of the asserted claims of the '317 and '863 patents are invalid for failure to disclose the best mode. However, this court reverses the district court's summary judgment that the asserted claims are indefinite under 35 U.S.C. § 112 ¶ 2 and remands for further proceedings in accordance with this opinion.

AFFIRMED-IN-PART, REVERSED-IN-PART, AND REMANDED.

COSTS

Each party shall bear its own costs.