

UNITED STATES DISTRICT COURT FOR THE  
 EASTERN DISTRICT OF TENNESSEE  
 AT GREENEVILLE

AFG INDUSTRIES, INC., and	)	
ASAHI GLASS COMPANY, LTD.	)	
	)	
v.	)	NO. 2:96-CV-244
	)	
CARDINAL IG COMPANY, INC. and	)	
ANDERSEN WINDOWS, INC.	)	

**MEMORANDUM OPINION**

This patent case is before the Court on remand from the United States Court of Appeals, Federal Circuit. *See AFG Industries, Inc. v. Cardinal IG Company, Inc.*, 224 Fed. Appx. 956, 2007 WL 964606 (Fed. Cir., March 30, 2007) (“Cardinal IV”). Currently pending before the Court are: 1) AFG Industries, Inc.’s (“AFG”) appeal of the decision of the United States Magistrate Judge on AFG’s motion for leave to add a new expert, [Docs. 411, 398]; 2) AFG’s motion for summary judgment of infringement, [Doc. 427]; 3) Cardinal’s motion for summary judgment of non-infringement, [Doc. 430]; 4) AFG’s Rule 56(f) motion for an order denying Cardinal’s motion for summary judgment of noninfringement or, alternatively, an order continuing the disposition of Cardinal’s motion for summary judgment of noninfringement and permitting AFG to engage in discovery, [Doc. 445]; and 5) Cardinal’s motion to modify the scheduling order, [Doc. 453]. Responses and replies have been filed and all motions are now ripe for disposition.<sup>1</sup> Oral argument was heard on August 21, 2008.

---

<sup>1</sup> These filings consist of approximately 2,000 pages of pleadings and supporting exhibits, transcripts and affidavits.

At oral argument, AFG announced that its Rule 56(f) motion had been rendered moot by the completion of certain depositions and that its appeal of the Magistrate Judge's decision was moot if the Court grants either of the competing motions for summary judgment. Cardinal's motion to modify the scheduling order was orally granted at the hearing and all existing deadlines, the final pretrial conference and the scheduled trial were all cancelled<sup>2</sup> until this Court could rule on the motions for summary judgment.

For the reasons which follow, Cardinal's motion for summary judgment will be GRANTED, AFG's motion for summary judgment will be DENIED, AFG's motion for leave to add a new expert will be DENIED as MOOT, AFG's Rule 56(f) motion will be DENIED as MOOT, and this case will be DISMISSED WITH PREJUDICE.

## **I. PROCEDURAL BACKGROUND**

This case, which has a lengthy, protracted and somewhat tortured history, is before the Court on its fourth remand from the Federal Circuit. A somewhat detailed review of the procedural background of the case is necessary, however, to the resolution of the motions before the Court. It is hoped, though without confidence, that this Court's resolution of the pending motions for summary judgment will bring to an end the tormented and costly existence of this litigation, although, in view of the significant disagreement between the parties over the scope of the Federal Circuit's mandate, at least one more trip to the Federal Circuit is likely assured.<sup>3</sup>

---

<sup>2</sup> The Court also orally informed the parties that the Magistrate Judge had been directed to delay acting on any of the numerous pending motions *in limine* until this Court ruled on the competing motions for summary judgment.

<sup>3</sup> This Court, too, must admit a certain degree of frustration at trying to bring this matter to conclusion. The case predates the undersigned's tenure on the bench by nearly three quarters of a decade;

The complaint in this case was filed on May 23, 1996, and assigned to United States District Judge Thomas G. Hull. AFG and Cardinal are competing manufacturers of windows with “low-emissivity” coatings, consisting of thin, alternating layers of metals coated onto a pane of glass. AFG holds patent No. 4, 859, 532 (the ‘532 patent), which is directed to a coating having multiple thin layers of silver, interspersed by layers of metal oxides, such as zinc oxide. Cardinal’s low-emissivity coatings contain layers of zinc oxide and silver, although in some of Cardinal’s products, multiple deposits of zinc oxide are applied sequentially on top of each other, with no intervening layers of silver. AFG claims that Cardinal’s products infringe its ‘532 patent.

Judge Hull held a Markman hearing<sup>4</sup> on January 13-14, 1998, to construe disputed terms of the ‘532 patent. On April 7, 1998, the Court granted Cardinal’s motion for summary judgment of non-infringement and AFG appealed. Finding that a precise and correct definition of “layer” was needed, the Federal Circuit held that the district court’s definition of “layer” was incorrect, vacated the judgment of non-infringement and remanded the case for a correct definition of layer and other disputed terms. *See AFG Industries, Inc. v. Cardinal IG Company, Inc.*, 178 F.3d 1312 (Fed. Cir. 1999) (“Cardinal I”).

---

yet, an incredible amount of this Court’s time has been spent over the last five years attempting to hit what has seemed to be a moving target. More than 500 entries have now been made on the case’s docket sheet, thousands upon thousands of pages of pleadings, briefs, exhibits, and transcripts have been filed for the Court’s review, hundreds of thousands of dollars have likely been spent, and untold resources, both public and private, have been wasted. And, while this Court must shoulder the lion’s share of the blame, a review of the Federal Circuit’s opinions in this case suggests that the Federal Circuit, too, has some responsibility for the protracted litigation in this case. The Federal Circuit’s opinions, two by divided panels, have avoided a final decision, have sometimes lacked clarity and appear, to some extent, to be contradictory of each other.

<sup>4</sup> *See Markman v. Westview Instruments, Inc.*, 517 U.S. 370 (1996).

On remand, the parties submitted further briefings on claim construction and Judge Hull issued a memorandum opinion on February 25, 2000, construing the terms “layer” and “interlayer” and once again granted Cardinal’s motion for summary judgment of non-infringement. AFG appealed a second time. Finding “that the district court erred by adopting a construction of the terms ‘layer’ and ‘interlayer’ that contradicts the manner in which these terms are used in the patent specification,” the Federal Circuit again vacated the judgment of non-infringement and remanded the case. *AFG Industries, Inc. v. Cardinal IG Company, Inc.* 239 F.3d 1239 (Fed. Cir. 2001). (“Cardinal II”) In *Cardinal II*, the Federal Circuit revised the claim construction and defined certain terms but nevertheless found the “underlying findings of the trial court and the factual record” insufficiently clear to resolve the issue of infringement. *Id.*

On remand for the second time, Judge Hull reevaluated the matter in light of the Federal Circuit’s claim construction and once again granted Cardinal’s motion for summary judgment of non-infringement, finding, based on the Federal Circuit’s construction of the term “layer”, that because the accused products contain multiple, sequentially deposited layers of zinc oxide, Cardinal could not infringe. At the same time, Judge Hull denied Cardinal’s motion for summary judgment of invalidity, finding the ‘532 patent to be valid<sup>5</sup>. Hence, the case was on its way to the Federal Circuit for a third time.

Finding that the district court had determined that a “layer” was defined further by its method of formation, the Federal Circuit once again vacated the judgment of non-infringement and remanded the case for a third time. *AFG Industries, Inc. v. Cardinal IG Company, Inc.* 375 F.3d

---

<sup>5</sup> In *Cardinal II*, the Federal Circuit had noted that Cardinal had moved for summary judgment of invalidity in light of the prior art, but that the district court had not addressed the motion. The district court was specifically directed to resolve the motion on remand. Cardinal did not appeal Judge Hull’s decision on validity.

1367 (Fed. Cir. 2004) (“Cardinal III”). The Federal Circuit held that “the determination of whether a particular structure is a ‘layer’ within the meaning of the claim is not affected by the method of creation of that structure,” and remanded the case “[b]ecause the trial court considered the method of creating the layer dispositive . . .” *Id.* at 1373. The Federal Circuit characterized the “basic inquiry” as “whether the thickness of titanium dioxide—regardless of whether it is 20 or 40Å—in Cardinal’s LoE<sup>2</sup> products affect the optical properties of the coatings.” *Id.* at 1374.

After the third remand, the case was reassigned to the undersigned district judge.<sup>6</sup> On January 3, 2005, Cardinal filed a renewed motion for summary judgment of invalidity, [Doc. 193]. After the motion was fully briefed, this Court denied the motion, holding that, because of Cardinal’s failure to appeal Judge Hull’s ruling in regard to invalidity, that ruling became the law of the case and Cardinal could not assert invalidity based on the prior art (the Goodman Patent), [Doc. 226]. After considerable pre-trial litigation, the case proceeded to a jury trial on July 25, 2005. On July 29, 2005, at the conclusion of all proof, the Court granted plaintiff’s oral motion for judgment as a matter of law and the case was submitted to the jury on the issue of damages only. The jury determined a royalty rate of \$2.81 and judgment in favor of AFG was entered on August 9, 2005. Notice of appeal was filed by Cardinal on September 6, 2005, [Doc. 364], and the case was on its well traveled path back to the Federal Circuit.

On March 30, 2007, the Federal Circuit affirmed the judgment of infringement as to any Cardinal “products whose central zinc oxide core is produced by a single sputter deposit” but reversed “as to products that were produced from at least two sputtering deposits for the zinc oxide

---

<sup>6</sup> United States District Judge Thomas G. Hull had taken Senior Status while *Cardinal III* was on appeal.

central core,” and remanded the case “for finding of the relevant facts,” *see Cardinal IV* at 957, 959, 2007 WL 964606 \*\*1, \*\*3; thus, the competing motions referenced above.

Because the parties disagree about the proper interpretation of the Federal Circuit’s prior decisions and the scope of the remand in *Cardinal IV*, a more detailed discussion of the patent, the Cardinal products at issue and the relevant prior decisions is needed.

#### **A. The ‘532 Patent**

In the late 1980's, Takuji Oyama, a scientist employed by Asahi Glass Company, Ltd. (“Asahi”), was named an inventor in a patent application which eventually matured into the ‘532 patent. The ‘532 patent claims a glass window with a coating to reflect infrared light with the coating having multiple thin layers of silver, interspersed by layers of metal oxides, such as zinc oxide. By alternating layers of silver with layers of metal oxides, Oyama disclosed that the silver would become increasingly reflective of radiant heat without sacrificing its transparency to visible light. Oyama also recited that “interlayers” could be laid between the silver and metal oxide layers. These interlayers, which are sufficiently thin to avoid substantially changing the optical properties of the silver and metal oxide layers, serve the purpose of rendering the layers more durable and increasing their adhesivity.

The sole claim of the ‘532 patent reads:

1. A transparent laminated product comprising a transparent substrate and a 5-layered transparent coating composed of a first ZnO layer formed on the substrate, a second Ag layer formed on the first layer, a third ZnO layer formed on the second layer, a fourth Ag layer formed on the third layer and a fifth ZnO layer formed on the fourth layer, and having a visible ray transmission of at least 60%, wherein the thickness of each Ag layer is from 60 to 250.

‘532 Patent, Col. 10, ll. 59-67. AFG and Asahi are joint owners by assignment of the ‘532 patent.

## B. Cardinal's Products

The Federal Circuit has described the accused Cardinal products in both *Cardinal II* and *Cardinal III*. Because the language differs somewhat, the Court will set out the full description of the Cardinal products from both decisions. In *Cardinal II*, the Federal Circuit described Cardinal's accused products as follows:

Cardinal's low-emissivity coatings contain layers of zinc oxide and silver, although in some of Cardinal's products, multiple deposits of zinc oxide are applied sequentially on top of each other, with no intervening layers of silver. Some of the layers in Cardinal's products, moreover, are separated by thin deposits of titanium dioxide, referred to by Cardinal as "barrier" layers. And, some of Cardinal's accused products have an "overcoat" or "topcoat" of a thin deposit of silicon nitride or zinc oxide on top of the other layers of the coating.

Cardinal applies its barrier layers in the following manner. After first depositing a layer of zinc oxide, Cardinal "sputters" a layer of silver onto the zinc oxide in a nonreactive argon atmosphere. Cardinal thereafter applies a relatively thin deposit of titanium metal on top of the silver, again in a nonreactive argon atmosphere. Zinc oxide is then deposited on the titanium layer in a reactive atmosphere containing oxygen. This causes the titanium to oxidize, forming titanium dioxide. Were the titanium not present, the silver layer would be exposed to the reactive atmosphere and would itself be oxidized, rendering the silver black and the product unacceptable for sale. Elemental analyses of the different regions of Cardinal's accused coatings indicate that silver and zinc oxide molecules can become incorporated into the relatively thin titanium dioxide barriers.

*Cardinal II* at 1243.

Cardinal's products are described as follows in *Cardinal III*:

Cardinal markets low-emissivity glass that are known as LoE<sup>2</sup> products. To produce its LoE<sup>2</sup> products, Cardinal uses magnetron sputter deposition. This sputter deposition method moves a glass sheet through coat zones. In each coat zone, the method deposits a thickness of material on the glass. The deposited material may be, for example, silver(Ag) in one zone and zinc(Zn) in another.

Furthermore, this deposition method also permits the manufacturer to control the atmosphere in each zone to provide nonoxidized or oxidized deposition. Zinc deposited in an oxygenated atmosphere, for example, produces a layer of zinc oxide (ZnO). Although discussing the method of depositing layers of zinc oxide, this Court recognizes that the 532 claim is a product claim that covers this inventive glass structure however it is made or however it is used. *See Vanguard Prods. Co. v. Parker Hannifin Corp.*, 234 F.3d 1370, 1372 (Fed. Cir. 2000) (explaining that “[t]he method of manufacture . . . does not of itself convert product claims into claims limited to a particular process”).

*Cardinal III* at 1370

**C. *Cardinal II***

As set forth above, the Federal Circuit initially remanded this case for the district court to define certain disputed terms of the ‘532 patent, including the term “layer.” After the grant of summary judgment of non-infringement, a second appeal was taken to the Federal Circuit. The Federal Circuit held that “the district court erred by adopting a construction of the term “layer” and “interlayer” that contradicts the manner in which these terms are used in the patent specification, . . .”, *Cardinal II*, 239 F.3d at 1241, vacated the grant of summary judgment and remanded for further proceedings.

The Federal Circuit discussed at some length the manufacturing process for the products at issue in the case and the relationship between the various metallic layers and interlayers or “barrier layers,” which are “important in the process of producing low-emissivity coatings, but that in the final *product* (as is claimed in this case), . . . may be disregarded.” *Id.* at 1245 (emphasis in original). The Federal Circuit identified as a “key issue” in the case how to distinguish between “layers” and “interlayers.” *Id.* at 1247. Noting that “[i]t is undisputed that Cardinal’s accused products contained deposits of titanium in addition to layers of silver and zinc oxide,” the Federal Circuit found that

“[d]etermining whether Cardinal’s products infringe the patent requires ascertaining whether these titanium deposits constitute “interlayers,” as would be covered by the patent claim, or additional “layers,” which would not.” *Id.* Finding that there is a substantial difference between “layers” and “interlayers” or “barrier layers,” the Court held that a proper claim construction must distinguish between layers and interlayers, something the district court did not do.

The Federal Circuit then adopted the following definition of “layer”: “[a] thickness of material of substantially uniform chemical composition, but excluding interlayers having a thickness not to substantially affect the optical properties of the coating.” *Id.* at 1250. Thus, held the Federal Circuit, the distinction between layers and interlayers focuses on whether the material is of such thickness and composition as to substantially affect the optical properties—if it does, it is a layer; if it does not, it is an interlayer. Applying this standard, the Federal Circuit concluded that the record was unclear as to what constitutes an optically significant thickness of titanium. The Court also directed that on remand the district court should resolve Cardinal’s motion for summary judgment of invalidity. *Id.* at 1252.

#### **D. This Court’s Ruling on Validity**

On August 13, 2001, after the second remand from the Federal Circuit, Cardinal filed a renewed motion for summary judgment of invalidity<sup>7</sup> on grounds that the Goodman patent discloses every limitation of the ‘532 patent and, therefore, anticipates the ‘532 patent.<sup>8</sup> [Doc. 148]. In *Cardinal II*, the Federal Circuit had defined the term “layer”, used in claim1 of the ‘532 patent, as

---

<sup>7</sup> The prior motion had been dismissed as moot on April 7, 1998, after the Court had granted Cardinal’s motion for summary judgment of non-infringement.

<sup>8</sup> A patent is invalid for anticipation when the same device or method, having all the elements contained in the claim limitations, is described in a single prior art reference. *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236 (Fed. Cir. 1989).

“a thickness of material of substantially uniform chemical composition, but excluding interlayers having a thickness not to substantially affect the optical properties of the coating.” *Id.* at 1250. Thus, applying that definition, the product described in claim 1 of the ‘532 patent is a transparent substrate, such as a glass substrate, and a laminated coating of five layers made of either zinc oxide or silver affixed in the following order: zinc oxide, silver, zinc oxide, silver, zinc oxide (ZnO/Ag/ZnO/Ag/ZnO). Each layer of silver must be between 60 and 250 angstroms thick. The innermost and outermost layers of zinc oxide have a thickness of 200 to 600 angstroms while the middle layer of zinc oxide has a thickness of from 400 to 1200 angstroms.

The Goodman patent (U.S. Patent No. 4,943, 484) is also directed to a glass substrate with a laminated coating. The technology disclosed in the Goodman patent was known as early as August, 1986, 15 months before the filing date of the ‘532 patent. Goodman’s coating is also composed of layers of zinc oxide and silver affixed in the following order: zinc oxide, silver, zinc oxide, zinc oxide, silver, zinc oxide (ZnO/Ag/ZnO/ZnO/Ag/ZnO). The layers of silver are described as 25 to 50 angstroms thick and the layers of zinc oxide as 100 to 500 angstroms thick.

Cardinal asserted that the technology disclosed in the ‘532 patent is not new and was described completely in the Goodman patent. More specifically, Cardinal asserted that the center region of zinc oxide in the Goodman patent, described as a center double layer, is in reality the same as the ‘532 patent’s center or third layer of zinc oxide. Since all the limitations of claim 1 the ‘532 patent are met by Goodman, Cardinal argued, Goodman anticipates the ‘523 patent and the ‘532 is invalid. The only difference, according to Cardinal, is semantics-the Goodman patent refers to its center region as two layers while the ‘532 patent refers to its center region as one layer.

Importantly, Cardinal also argued that the *process* by which the Goodman and ‘532 coatings

are made is irrelevant, referring to the testimony of AFG's expert witness, Dr. Gordon. Dr. Gordon testified that if a coating is manufactured by placing a glass substrate in a first deposition chamber in which a material is applied and then transferred to a second chamber in which more of the material is applied, the resulting product has two layers instead of one. In other words, the process by which a coating is manufactured determines whether that coating invalidates the '532 patent. Cardinal strenuously argued, therefore, that it was the actual structure of the Goodman coating, not its method of manufacture, that was the proper focus of the Court's inquiry.

AFG responded to Cardinal's motion by arguing that the Goodman patent could not anticipate the '532 patent because Goodman's '484 patent discloses not a 5-layered coating but a 6-layered coating "which [is] *produced* by simply doubling a 3-layered coating." [Doc. 158, p.2].

AFG cited the response of Goodman to the patent examiner's initial rejection of Goodman's primary claim, which led to the examiner's withdrawal of the examiner's objection. Goodman responded to the objection by saying:

Applicant's dielectric layers are typically formed of the same material. However, each of the dielectric layers can be formed of a different material since each layer is individually deposited one on top of the other. Thus, applicant believes that the language in claim 1 setting forth six layers is correct whether or not the third and fourth layers are formed of the same material.

*Id.* at p. 3.

AFG argued that it was thus clear that there existed a distinction between five layered and six layered coatings, even when the two adjacent middle layers are the same material, although deposited individually (*i.e.* one on top of the other). AFG also cited and relied upon Dr. Goodman's own concurring opinion. AFG, in addition, advanced arguments that the coatings of the Goodman and '532 patents were substantially different in structure, durability and color adjustability.

Although AFG stressed that its argument against anticipation was not based on the process by which the Goodman coating is made, it is clear that it rested, in large part, on the manner of production of the coatings.

In ruling on Cardinal's motion, Judge Hull made some important findings of fact, including that the Goodman coating is a 6-layer coating while a '532 coating is a 5-layer coating and that nothing in the '532 patent is directed toward durability or color adjustability. Citing the prosecution history of the Goodman patent, Judge Hull noted that the Goodman coating consists of six layers and "each layer is individually deposited one on top of the other," regardless of whether or not the third and fourth layers are formed of the same material. [Doc. 177, p. 9]. Judge Hull also credited the testimony of Dr. Gordon, AFG's expert, who testified about his experience with producing multi-layer coatings where the layers were the same material made "by depositing subsequently one layer on top of the other." *Id.* at p. 11. Dr. Gordon explained the reasons for making several depositions of the same material rather than one thicker deposit of the same material. Dr. Gordon stated: ". . . In passing a substrate through a deposition zone a certain amount of material is deposited; and sometimes for physical limitations of speed, we can't move it more slowly than a certain speed; and if we want to move a, enough material to examine by a certain method, we may make several passes through the same deposition zone." *Id.* Dr. Gordon described such a process as resulting in a multi-layer coating.

Based upon his findings of fact, Judge Hull made the following conclusions of law:

Utilizing the Federal Circuit's definition of the term "layer", *i.e.*, "a thickness of material of substantially uniform chemical composition, but excluding interlayers having a thickness not to substantially affect the optical properties of the coating," based upon the testimony of Professor Gordon, as well as utilizing the prosecution history of the '484, the Court finds that specification of

the '532 patent does not limit the term "layer" to a deposit bounded by a material of a different chemical composition, and the Court declines to include such a limitation in the construction of the term "layer."

The Court also finds that based upon the Declaration of Professor Goodman in regard to the issue of obviousness, the claimed subject matter of the '532 patent would not have been obvious to one of ordinary skill in the low emissivity coating art as of November 1986. Therefore, the Court finds that Goodman's '484 patent does not anticipate claim 1 of the '532 patent because it does not disclose a "5-layered transparent coating" with enhanced durability. Instead, the Goodman '484 discloses a coating with six distinct layers which was less durable.

[Doc. 177, pp. 16-17].

**E. *Cardinal III***

After the District Court had reevaluated the claim construction in light of the opinion in *Cardinal II*, it again granted summary judgment of non-infringement to Cardinal. On appeal for the third time, the Federal Circuit described the district court's determination as follows:

. . . In particular, the district court determined, as it understood this Court to have instructed, that a "layer" was defined further by its method of formation. Because the accused products contain multiple, sequentially deposited layers of zinc oxide, the trial court determined that Cardinal could not infringe. The district court separately determined that some accused products contain a layer of titanium dioxide, which would also preclude infringement. Although not appealed, the district court also held the Goodman patent did not anticipate the '532 patent.

*Cardinal III*, 375 F.3d at 1371.

Noting that its *Cardinal II* decision had established the meaning of "layer," the Federal Circuit described the scope of its remand in *Cardinal II* as having "open[ed] only the second step of the infringement analysis, namely the application of the claim to the accused device." *Id.* at 1372. "In other words," the Court said, the remand in *Cardinal II* was for the District Court "to determine

as a matter of law ‘whether a chemical compound that has been deposited in multiple separate, sequential applications, without intervening layers or interlayers, constitutes a single ‘layer’.’” *Id.* The Federal Circuit rejected an argument by Cardinal that, because it “successively deposits 200 of zinc oxide until achieving a thickness ranging from 600 to 890” resulting in “3 to 4.5 layers of zinc oxide,” its products cannot infringe, holding that Cardinal was asking the Court “to adopt a new construction of the claim that would impermissibly *import a process limitation with a pure product claim*, and that “the term “layer” in the ‘532 patent does not require *any particular method of manufacture*.” *Id.* at 1372-73 (emphasis added).

The Federal Circuit further explained:

... In other words, Cardinal’s process of successive depositions does not provide conclusive information about whether its products contain a single layer of zinc oxide. Multiple depositions of the same material, for instance, would form a single layer if those additional depositions have no optical effect different from than that of a single deposition of the same thickness. On the other hand, if multiple depositions do not create a unitary structure having the same optical properties of a single deposition of the same thickness, the product will have [sic] not have a single layer-not because of the method of application but because of the structure and optical properties resulting from the application. Thus, *multiple depositions are only relevant if they affect the structure and optical properties*.

In sum, the determination of whether a particular structure is a “layer” within the meaning of the claim *is not affected by the method of creation of that structure*. A structure that falls within the meaning of “layer” due to its structure and optical properties remains a single layer *whether it was deposited in a single sputtering operation or multiple operations*. By the same token, that unitary structure of the same material that constitutes a “layer” *does not become multiple layers because the manufacturer decided to deposit it in multiple passes rather than in a single pass*. The method of making is not determinative of the structure and properties of a “layer.” Because the trial court considered the method of creating the layer dispositive of its structure and character in the accused LoE<sup>2</sup> products, this court vacates the grant of summary judgment.

*Id.* at 1373. (emphasis added)

The Federal Circuit then remanded the case yet again to the district court for a factual determination of whether Cardinal’s successive depositions of zinc oxide form a single layer or multiple layers. More specifically, the Federal Circuit remanded for resolution of “the basic inquiry, that is, whether the thicknesses [of] titanium dioxide—regardless of whether it is 20 or 40A—in Cardinal LoE<sup>2</sup> products affect the optical properties of the coatings.” *Id.* at 1374.<sup>9</sup>

#### **F. Proceedings in the District Court After Third Remand**

After this third remand, the parties resumed their vigorous pretrial litigation. Cardinal filed a renewed motion for summary judgment of invalidity, [Doc. 193], which this Court denied on the basis that Judge Hull’s prior holding on invalidity, not appealed by Cardinal in *Cardinal III*, was the law of the case and that invalidity could not be asserted by Cardinal on the basis of the Goodman patent. [Doc. 226]. Neither party moved for summary judgment on the issue of infringement and the case was set for trial on July 19, 2005, and later reset for July 25, 2005. Numerous pretrial motions were filed by the parties. One is of particular import in understanding the proceedings after the third remand, however.

AFG moved *in limine* (the “second motion *in limine*”) that Cardinal be prohibited from “presenting any arguments, testimony, and/or other evidence at trial about the processes of manufacture” of the Cardinal products, [Doc. 238], arguing that the “process by which Cardinal’s products are made is irrelevant” on the issue of infringement. AFG, relying in large part on the

---

<sup>9</sup> As noted above, at pages 7-8, Cardinal uses a sputter deposition method to produce LoE<sup>2</sup> products. This method moves the glass through coat zones where, in each coat zone, a thickness of material is deposited on the glass. All of Cardinal’s products contain a center thickness of zinc oxide produced by at least three separate depositions. Each deposition results in a thickness of material of 200A of zinc oxide, “until achieving a thickness ranging from 600 to 800A.” *Cardinal III*, 375 F.3d at 1372-73.

language of *Cardinal III* quoted above, argued that the Federal Circuit had “already held in this very case that consideration of the process used to manufacture Cardinal’s products is irrelevant to the question of infringement of the ‘532, because the terms of the “pure product claim” of the ‘532 patent are defined by structure--not process.” *Id.* at p. 4. Cardinal responded in opposition, [Doc. 268], to the motion, arguing that AFG had distinguished the Goodman and Oyama patents by the process by which the center zinc oxide region of the coatings is deposited, *i.e.* the manufacturing processes, and that the structural differences result only from Goodman’s two-step deposition process. Arguing further that Cardinal likewise deposits the center zinc oxide region of the accused products in multiple steps, Cardinal asserted that “AFG’s request to exclude this evidence . . . is an attempt to win on validity by demonstrating to the Court that two depositions equal two “layers” and win on infringement by demonstrating to the jury that multiple depositions equal one “layer.”” *Id.* at p. 15.

AFG also moved *in limine* (the “third motion *in limine*”) that Cardinal be precluded from introducing evidence related to the optical properties of certain Cardinal test samples which were prepared with either no titanium barriers or only 10A titanium barriers. More specifically, AFG argued that the absence of titanium oxide allowed the silver to discolor, which resulted in reduced visible light, and that allowing Cardinal to argue that the titanium oxide level is “optically significant” was contrary to the direction of the Federal Circuit.

The motions were referred to the Magistrate Judge pursuant to 28 U.S.C. § 626. The Magistrate Judge concluded that AFG’s second motion *in limine* was “too broad” and correctly held, or so it appeared to the undersigned, that the issue for trial was whether or not successive, sequential coatings of zinc oxide constitute a “layer,” a matter to be determined based upon the “optical

significance” of those successive zinc oxide coatings, not the process of manufacture. The Magistrate Judge recognized that Cardinal must necessarily prove to some degree its process, but without reference to the Goodman patent. *See* Doc. 305.

The Magistrate Judge granted AFG’s third motion *in limine*, agreeing with AFG’s position:

The Federal Circuit Court of Appeals flatly held that optical significance is determined by “the thickness and composition of the material itself . . . , rather than [by] whether the absence of that material would lead to oxidation and discoloration of the adjacent layers.” 239 F.3d at 1250. Thus, to the extent that any evidence or opinion offered by Cardinal is premised on oxidation or discoloration of the silver coating due to the absence (or lack of thickness), this motion *in limine* is well taken . . . . Therefore, the “optical significance” of the titanium dioxide coating (or for that matter, successive, sequential coatings of zinc oxide) must be determined by the coating’s effect on the silver coating *apart from* mere discoloration (oxidation) of that silver coating. Since these test results were caused by discoloration of the silver lining, they are irrelevant . . . .

[Doc. 305, p. 6].

Cardinal did not appeal the Magistrate Judge’s order on the second motion *in limine*, [*See, e.g.,* Doc. 328]; AFG, however, moved for reconsideration,<sup>10</sup> making much the same argument it made in its motion *in limine*. Cardinal appealed the Magistrate Judge’s order on the third motion *in limine*. After hearing oral argument, this Court affirmed the Magistrate Judge’s ruling on the second motion *in limine* and took the appeal on the third motion *in limine*<sup>11</sup> under advisement,

---

<sup>10</sup> This Court treated the motion for reconsideration as an appeal of the Magistrate Judge’s order.

<sup>11</sup> During the Magistrate Judge’s hearing on these motions, Cardinal’s attorney acknowledged that the process of manufacture, i.e. the number of steps used to deposit the zinc oxide, had no optical significance: “It doesn’t matter how many steps you use to lay down that zinc oxide, it’s still zinc oxide, it’s one layer; and optically it’s the same whether you laid it down in four steps or one step.” Moreover, Cardinal’s attorney admitted during oral argument before the undersigned on July 25 that multiple depositions do not affect the optical properties. He argued, however, that multiple depositions affect the resulting “structure.” Consistent with the directive of the Federal Circuit that “multiple depositions are only relevant if they affect the structure *and* optical properties,” Cardinal’s proof about its method of

pending testimony from Cardinal's expert witness outside the presence of the jury. The Court heard the expert testimony in a jury out hearing on July 28, 2005, confirmed that the optical effect of the titanium on the silver was as a result of oxidation or discoloration, and affirmed the Magistrate Judge's ruling. Because Cardinal had offered no proof to establish that multiple depositions of titanium dioxide created multiple layers, *i.e. had any effect on the optical properties of the coatings*, the Court granted AFG's motion for judgment of infringement as a matter of law and the case was submitted to the jury on the question of damages.

#### **G. Cardinal IV**

The case was thus destined for a fourth trip to the Federal Circuit. Reviewing this Court's judgment in combination with the prior proceedings, the Federal Circuit concluded that:

The '532 patent claim, construed in light of the prior art and arguments in prior proceedings, and in order to preserve the validity as previously found, are limited to products whose central zinc oxide core is produced by a single sputter deposition. For such products, if any were produced by Cardinal, the judgment of infringement and the jury's measure of damages at the designated royalty rate are *affirmed*. However, on this claim construction infringement cannot be sustained as to products that were produced from at least two sputtering deposits for the zinc oxide central core; the judgment of infringement is reversed as to those products.

The record of this appeal does not show what portion, if any, of the Cardinal product line for the period at issue was produced by single sputtering deposits of the central zinc oxide layer. For allocation of damages in accordance with the proportion of infringing product, we remand to the District Court.

*Cardinal IV*, 224 Fed. Appx. at 957.

---

manufacture of its product was excluded. The reason for Cardinal's lack of appeal of the Magistrate Judge's order on the second motion *in limine* appeared to be obvious. It is not clear why the failure of Cardinal to appeal the Magistrate Judge's order on the second motion *in limine* did not constitute a waiver of its argument, made in the Federal Circuit, that its process of manufacture was relevant on the issue of infringement.

The Federal Circuit found the claim construction of the '532 patent in view of the Goodman patent to be pertinent for purposes of the appeal since “AFG distinguished Goodman in an earlier district court proceeding by arguing that the zinc oxide central core of the AFG product is produced in a single sputtering deposition, thereby achieving advantages of durability over the Goodman product, whose central core consists of two contiguous layers of zinc oxide.” *Id.*<sup>12</sup> Cardinal argued in this fourth appeal that the JMOL of infringement was error, “arguing that since this ruling of patent validity requires that the zinc oxide central core is a singly-deposited layer, the Cardinal product with a multiply-deposited zinc oxide central core cannot infringe.” *Id.* at 958. AFG’s position on appeal was that only optical properties are relevant under the holding of *Cardinal III* and that a claim construction limited to a particular method of production was improper.

The Federal Circuit agreed with Cardinal that, although it is generally the case that product claims are not limited by how the product is produced, an exception arises when the product’s distinction from the prior art depends on how it was produced, “for when the validity of the patent depends on use of a particular process, the claims are construed in the manner that will sustain their validity, when such construction is supported by the record.” *Id.* citing *Whittaker Corp. v. UNR Industries, Inc.*, 911 F.2d 709, 712 (Fed. Cir. 1990). As a result, the Federal Circuit stated:

In a previous opinion in this case, the Court observed that “Cardinal’s accused LoE<sup>2</sup> products contain a center thickness of zinc oxide

---

<sup>12</sup> It is also unclear why this holding was not made in *Cardinal III* or why the Federal Circuit held in *Cardinal III* that the process of depositing material in multiple depositions was irrelevant unless it, *i.e.* the thickness of the material, affected the optical properties of the coatings. In *Cardinal IV*, it is the process only which is now important and effect on the optical properties has now become irrelevant. While it is difficult to discern a legal rationale for the apparent about face by the Federal Circuit in *Cardinal IV*, this Court must nevertheless comply with that Court’s mandate. It now appears that the Federal Circuit has taken the same position as Judge Hull after the first remand, *i.e.* that products produced by multiple depositions cannot infringe the '532 patent, and that the subsequent appeals and remands were completely unnecessary.

produced by at least three separate depositions.” *AFG Industries, Inc. v. Cardinal IG Co.*, 375 F.3d 1367, 1370 (Fed. Cir. 2004). Although AFG argues that it is too late for Cardinal now to rely for noninfringement on how the zinc oxide core is produced, AFG’s single-sputter deposition was the basis of the district court’s ruling that the ‘532 patent is not obvious or anticipated by the Goodman reference. Thus the single-sputter limits the AFG claim, and the claim cannot be infringed by Cardinal products whose zinc oxide central core is produced by multiple depositions.

*AFG states that it has not been established whether all of the Cardinal products are produced by multiple depositions for the zinc oxide central core, and that Cardinal may have changed its process during the period of litigation.* We remand to the District Court for finding of relevant facts, because any Cardinal products produced by a single sputter deposition for their zinc oxide core remains subject to the judgment of infringement.

*Id.* at 959. (emphasis added)

### **III. ANALYSIS AND DISCUSSION**

Not surprisingly, Cardinal and AFG have fundamental disagreement about the issues remaining to be decided in this case. They disagree on everything from the scope of the Federal Circuit’s remand to the application of the Federal Circuit’s mandate to the facts of the case. Before discussing the Court’s analysis of the issues in the case, the Court will briefly summarize the respective positions of the parties as set forth in their competing motions for summary judgment.

#### **A. Cardinal’s Motion [Doc. 430, 431]**

The Federal Circuit determined, in *Cardinal IV*, that plaintiff’s patent was “limited to products whose central zinc oxide core is produced by a single sputter deposit.” *Cardinal IV*, 224 Fed. Appx. at 957. The Federal Circuit recognized that “Cardinal’s accused LoE<sup>2</sup> products contain a center thickness of zinc oxide produced by at least three separate depositions.” *Id.* at 959, quoting *Cardinal III*, 375 F.3d at 1370. However, because AFG argued that Cardinal may have changed its

process during the time of the litigation, the case was remanded to this Court for a narrow purpose—determining whether any Cardinal products were made with a single sputter deposit. Cardinal phrases the question to be decided on remand as “whether Cardinal changed its process during the litigation from using at least three separate depositions, to using a single deposition, to make the central zinc oxide core of the accused products.”

The accused Cardinal products were produced from 1991 to 2001 at facilities in Wisconsin, Texas, Minnesota and Washington. AFG accused eight versions of Cardinal’s LoE<sup>2</sup> products of infringement. The general structure of the accused products is the same except for slight differences in the thicknesses of the various deposits that comprise the coating.<sup>13</sup> Cardinal uses a process known as magnetron sputter deposition to manufacture its LoE<sup>2</sup> coatings. In this process, the glass travels through a coater on a conveyer system where it passes from one “coat zone” to another.<sup>14</sup> As the glass passes through each coat zone, a “target” of material, *i.e.*, a thickness, is deposited sequentially on the glass. The central zinc oxide core of the accused products ranges from 600 to 890 angstroms, with approximately 200 angstroms of zinc oxide deposited in each coat zone. It is undisputed that Cardinal did not change its process during the time of the litigation and that, at all times, Cardinal has used at least three coat zones to form the central zinc oxide core of the accused products.

---

<sup>13</sup> The parties essentially stipulated to this at trial, indicating to this Court that either all of the Cardinal products infringe or none do. The parties stipulated the total number of square feet of glass produced during the relevant time period and this Court established the amount of the judgment by multiplying the royalty rate found by the jury by the number of square feet. In view of this stipulation, the Federal Circuit’s remand for further fact finding is surprising.

<sup>14</sup> Cardinal equates “sputter deposit” with “coat zone.” AFG, on the other hand, makes much of its argument that “coat zone” is not mentioned in *Cardinal IV*. While AFG is correct that the Federal Circuit does not mention “coat zone” in *Cardinal IV*, the context clearly supports Cardinal. Once again, however, the Federal Circuit could have more clearly stated its holding.

In *Cardinal III*, the Federal Circuit described how Cardinal’s sputter deposition is used, with glass sheets moving through a series of coat zones, with approximately 200 angstroms of zinc oxide being deposited in each coat zone. *Cardinal III*, 375 F.3d at 1370, 1372. The Court said “[i]n each coat zone, the method deposits a thickness of material on the glass,” *Id.* at 1370, and equated the 200 angstroms of zinc oxide from each coat zone to a “deposit.” *Id.* at 1372 (“Cardinal successively deposits 200 [angstroms] of zinc oxide . . .”). The Federal Circuit concluded, therefore, that “Cardinal’s accused LoE<sup>2</sup> products contain a center thickness of zinc oxide produced by at least three separate depositions.” *Id.* at 1370.

In *Cardinal IV*, the Federal Circuit determined that plaintiff’s patent was “limited to products whose central zinc oxide core is produced by a single sputter deposit.” *Cardinal IV*, 224 Fed. Appx. at 957. The Federal Circuit in *Cardinal IV* recognized what it had already recognized in *Cardinal III*, *i.e.*, that the accused Cardinal products “contain a center thickness of zinc oxide produced by at least three separate depositions.” *Id.* at 959. Thus, Cardinal argues, it is undisputed that there is no infringement of plaintiff’s patent in this case and Cardinal is entitled to the entry of a summary judgment of noninfringement.

#### **B. AFG’s Motion [Doc. 427, 428]**

AFG has a completely different view of *Cardinal IV*. AFG argues that, for the first time, *Cardinal IV* decided that the process by which Cardinal’s products were made was important and must be considered in deciding infringement. AFG characterizes the mandate of the Federal Circuit in *Cardinal IV* to require this Court to determine whether some or all of Cardinal’s accused products were made by the same process which yielded the Goodman product. AFG argues that the

Goodman product is made by a two-pass process, in which glass is passed through the same coating line twice and sees the issue before this Court on remand as whether any of Cardinal's products were made by this two-pass process. Cardinal products made by the two-pass process then, according to AFG, would be excluded from the accounting ordered by the Federal Circuit. It is undisputed that the Cardinal products at issue in this case were all produced by a process by which the glass was passed through the conveyer line only once, *i.e.*, a one pass process.

Goodman describes his product as having six layers individually deposited one on top of the other. The two individual depositions of zinc oxide, one on top of the other, produced the two-layer middle zinc oxide core of the Goodman product. In support of its position, AFG refers to certain testing done by Cardinal's expert to replicate the Goodman product. In order to obtain the two individual deposits of zinc oxide in the middle of the Goodman product, Cardinal's expert found it necessary to pass the glass through the sputter line twice. In contrast, AFG argues, it is undisputed that when Cardinal manufactures its accused product the glass makes but a single pass through the sputtering line, resulting in a single middle zinc oxide layer. Hence, concludes AFG, the distinguishing process feature is one-pass verses two-pass through the sputtering line; thus, a "single sputter deposit" is made when glass passes through a sputtering line once, as opposed to multiple sputter deposits, which occur when the glass passes through the sputtering line two or more times. Because there is no dispute that Cardinal's accused products are not made using the two-pass process of Goodman, AFG argues that all of the accused products remain subject to the judgment of infringement and subject to the jury's damage determination at trial. Alternatively, AFG seeks to use a newly retained expert to give testimony on the meaning of the word "deposit" as used by

the Federal Circuit.

### C. Discussion

While this Court acknowledges and understands the frustrations of AFG and its attorneys at what appears to be a change in the rules of the game by the Federal Circuit in the ninth inning,<sup>15</sup> this Court is nevertheless constrained to agree with Cardinal's position. Although the parties argue strenuously about its meaning, the scope of the remand from the Federal Circuit is relatively clear and straightforward. This Court was directed to determine which, if any, of the Cardinal products are produced by a single sputter deposition for their central zinc oxide core. If any are, they remain subject to the judgment of infringement; those which are produced by multiple depositions cannot infringe. AFG's argument that this Court must now compare the process used to produce the Goodman product with the process used to produce the Cardinal products because process has now become important on the issue of infringement misses the point of the Federal Circuit decision. While it is true that *Cardinal IV* now makes process of manufacture important to the determination of infringement or non-infringement, it did so only to the extent that the method of production limits the AFG claim.

As noted by the Federal Circuit, Judge Hull's validity decision distinguished AFG's single sputter deposition process with the Goodman multiple deposition process to sustain the validity of

---

<sup>15</sup> AFG's attorney, at oral argument, stated that AFG believed "that in 2005 this Court did everything correctly, and that what happened before the Federal Circuit was improper." While this Court may agree with the statement, as did the dissenting judge in *Cardinal IV*, that is of no consequence with regard to the decision now to be made. As Cardinal's attorney pointed out at oral argument, one would think that after the case had been to the Federal Circuit four times, the Federal Circuit would issue an opinion that was not ambiguous in any respect, and "that everybody in the world would know what they were talking about." [Doc. 509, p. 20].

the '532 patent. In other words, the '532 patent is limited to the single sputter deposition method used by AFG. It is clear from the pleadings filed by the parties on the question of validity of the '532 patent that AFG distinguished the '532 patent from the prior Goodman patent on the basis that the '532 patent anticipated a product with five layers, each deposited on top of the other, while the Goodman patent anticipates a product of six layers with each layer individually deposited one on top of the other, regardless of the fact that the third and fourth layers may be formed by the same material. Said more simply, it appears that AFG advocated, and this Court accepted, a distinction between the Oyama patent and the Goodman patent of a product on the one hand with a single deposit of zinc oxide in the center and the Goodman product on the other which had two deposits or layers of zinc oxide in its center. The Cardinal products, on the other hand, are characterized by at least three deposits of zinc oxide to form its central core. Rather than resolving the question before the Court by comparing Cardinal's process with the one used to produce the Goodman product, the Federal Circuit directed a resolution by comparing the Cardinal process with the single sputter deposition process used by AFG.

AFG does make an argument which has considerable logical appeal. AFG argues that if Cardinal's present interpretation of the Federal Circuit directive in *Cardinal IV* is correct, there was no need for a remand; rather, if "deposit" and "coat zone" are synonymous, the Federal Circuit should have simply entered judgment of noninfringement in favor of Cardinal.<sup>16</sup> It is puzzling that the Federal Circuit did not do so. It had been previously noted by the Federal Circuit that all of

---

<sup>16</sup> Cardinal makes a similar argument, however, with the same logical appeal, *i.e.* that if AFG is correct and "sputter deposit" means a single pass through a multi-chamber coat line, there likewise would have been no reason for a remand, and the Federal Circuit would have simply affirmed, because it is undisputed that Cardinal uses a one-pass process. All of this simply reinforces the conclusion that the very limited purpose of the remand was for this Court to determine whether Cardinal's process had changed during the litigation.

Cardinal's products have a center thickness of zinc oxide produced by at least three separate depositions of that material and that all of the accused products were produced between 1991 and 2001. The answer, it seems, is found in AFG's argument before the Federal Circuit that Cardinal may have changed its method of production during the period of litigation, a position AFG's attorneys asserted in oral argument before this Court that it did not take in the Federal Circuit. Nevertheless, the Federal Circuit noted that "AFG states that it has not been established whether all of the Cardinal products are produced by multiple depositions for the zinc oxide central core, *and* that Cardinal may have changed its process during the period of litigation." *Cardinal IV*, 224 Fed. Appx. at 959 (emphasis added). Thus, it appears that the only relevant question for this Court is to determine whether or not any Cardinal products at issue in this litigation were produced as the result of a change in process during the period of the litigation. It is undisputed that none were.

Since it is undisputed that all of the accused Cardinal products have a central zinc oxide core produced by multiple depositions of zinc oxide, none of the accused products infringe the '532 patent and Cardinal is entitled to summary judgment of noninfringement. Therefore, Cardinal's motion for summary judgment, [Doc. 427], will be **GRANTED**, AFG's motion for summary judgment, [Doc. 430], AFG's appeal of the decision of the United States Magistrate Judge on AFG's motion for leave to add a new expert, [Doc. 411], the motion for leave to add a new expert, [Doc. 398], and AFG's Rule 56(f) motion [Doc. 455], will be **DENIED** as moot, and this case will, by separate order, be **DISMISSED WITH PREJUDICE**. All other pending motions in the case are **PRETERMITTED** and the Clerk is directed to terminate those motions.

ENTER:

s/J. RONNIE GREER  
UNITED STATES DISTRICT JUDGE