

IN THE UNITED STATES DISTRICT COURT
FOR THE MIDDLE DISTRICT OF NORTH CAROLINA

PRECISION FABRICS GROUP, INC.,)	
)	
Plaintiff,)	
)	
v.)	1:13-cv-645
)	
TIETEX INTERNATIONAL, LTD.,)	
)	
Defendant.)	
)	
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PRECISION FABRICS GROUP, INC.,)	
)	
Plaintiff,)	
)	
v.)	1:14-cv-650
)	
TIETEX INTERNATIONAL, LTD.,)	
)	
Defendant.)	

MEMORANDUM OPINION AND ORDER

THOMAS D. SCHROEDER, District Judge.

This is an action alleging patent infringement involving flame-retardant technology for fabrics. Before the court are two motions: Precision Fabrics Group, Inc. ("PFG") moves for partial summary judgment as to its claim against TieTex, Inc. ("TieTex") for infringement and TieTex's counterclaims alleging inequitable conduct and invalidity of PFG's patents (Doc. 111);¹ and PFG moves

¹ All citations are to the docket page in the record in case number 1:13cv645. TieTex has withdrawn its remaining counterclaims asserting abuse of process and unfair and deceptive trade practices. (Doc. 147.)

to exclude the testimony of TieTex's expert witness (Doc. 116). The court heard argument on the motions on October 25, 2016. For the reasons explained below, PFG's motion for summary judgment on its claim of patent infringement will be denied, its motion to exclude TieTex's expert witness will be granted in part and denied in part, and its motion for summary judgment on TieTex's counterclaims for inequitable conduct and invalidity will be granted and those claims will be dismissed.

I. BACKGROUND

PFG filed this action on August 6, 2013, alleging that certain TieTex products incorporating flame-retardant fabrics infringe PFG's U.S. Patents Nos. 8,796,162 ('162 Patent) and 8,501,639 ('639 Patent).² (Doc. 29 at 2-3.) PFG's patents describe lightweight materials designed to retard fire for a variety of applications, including garments, furniture, appliances, and vehicles. (Doc. 112-1 at 2; Doc. 112-2 at 2.)

PFG's patents began with its provisional patent application in May 2001. (Doc. 114 at 3.) Around 2004, TieTex began developing a similar fabric that would operate as a fire-retardant cloth for

² PFG's initial complaint claimed infringement of the '639 patent. A year after that lawsuit was filed, the '162 patent was issued. According to PFG, the '162 patent is a continuation of the '639 patent. (Doc. 1 at 3, 1:14-CV-650.) PFG unsuccessfully sought TieTex's consent to amend the initial complaint to include the '162 patent, but TieTex refused. (Id.) PFG thereafter filed a second complaint under docket number 1:14-CV-650 for the '162 patent. With respect to all pending motions, the docket filings are substantively identical.

mattresses. (Id.) TieTex coats its fabric with a solution known as SV-X41 (id. at 4), which is manufactured by Royal Adhesives and Sealants, Inc. ("Royal Adhesives") (Doc. 114-7 at 21). TieTex began infusing SV-X41 onto its fabrics around 2012. (Doc. 114 at 4.)

TieTex concedes that its fabrics generally function similarly to PFG's patented fabric but contends that they are not coated with an "intumescent," as covered by PFG's patents. (Doc. 133 at 7-8.) The parties disputed the meaning of the term "intumescent" (id.), and after briefing and a hearing on claim construction, this court held that "intumescent," as defined in PFG's patents, means "a substance that swells and chars upon exposure to heat or flame" (Doc. 57 at 20-21). TieTex subsequently conceded that its coating "charred" when exposed to heat or flame. (Doc. 133 at 7.) It continues to claim, however, that it does not "swell" under those conditions and therefore that TieTex's products do not infringe PFG's patents. (Id. at 18-19.) Thus, the parties agree that this issue – whether SV-X41 swells upon exposure to heat or flame – is the sole issue in PFG's infringement claim against TieTex. (Doc. 114 at 5; Doc. 133 at 7.) By way of its counterclaims, TieTex seeks a declaration that PFG's patents are invalid, partly based on its alleged inequitable conduct. (Doc. 32 at 10-22.) Before reaching the merits-based claims, however, the court must first address PFG's motion to exclude the testimony

of TieTex's expert witness, Dr. Richard Horrocks, upon whom TieTex relies to oppose PFG's infringement claim.

II. ANALYSIS

A. PFG's Motion to Exclude Expert Witness

TieTex seeks to offer the expert testimony of Dr. Richard Horrocks, a chemistry professor at the University of Bolton in England, who performed tests on SV-X41 and concluded that it did not swell under heat or flame. (Doc. 114-11 at 7; Doc. 119-2.) PFG moves to exclude his testimony on the grounds that it was not timely disclosed, and, alternatively, that it is inadmissible under Federal Rule of Evidence 702. Each ground will be addressed in turn.

1. Timeliness of Disclosure

PFG argues that the court should exclude Horrocks' expert report and testimony under Federal Rule of Civil Procedure 37(c)(1) because TieTex did not timely disclose what it describes as the "fundamental premise" of his opinion pursuant to Federal Rule of Civil Procedure 26(a)(2)(B). (Doc. 119 at 8.) TieTex contends that Horrocks' opinions and bases were adequately disclosed. (Doc. 132 at 10.)

Rule 37(c)(1) prevents a party from using testimony that it previously failed to disclose under Rule 26(a)(2). Under Rule 26(a), the party offering a retained testifying expert must provide a written report containing various categories of information

about the expert and his opinions. Fed. R. Civ. P. 26(a)(2)(B). Pertinent here, the report must include "a complete statement of all opinions the witness will express and the basis and reasons for them." Fed. R. Civ. P. 26(a)(2)(B)(i). Failure to timely provide the information required by Rule 26(a) may result in exclusion of the expert's testimony. Fed. R. Civ. P. 37(c)(1); S. States Rack & Fixture, Inc. v. Sherwin-Williams Co., 318 F.3d 592, 596-97 (4th Cir. 2003).

According to PFG, Horrocks' expert opinion that SV-X41 does not swell when exposed to heat or flame is based on his conclusion that an accurate test must involve a coating that is "thermally thin" - that is, less than 100 microns thick. (Doc. 119 at 8.) PFG further interprets his opinion to be that a thermally thin coating cannot be an intumescent. (Id.) It argues further that this understanding was not included in Horrocks' August 2015 expert report (Doc. 119-2) and was not disclosed until Horrocks' November 2015 deposition (Doc. 119-1), on the last day of expert discovery, just a week before the deadline for filing motions to dismiss and one month before the deadline for summary judgment motions. (Doc. 119 at 9.) PFG claims prejudice - because its expert, Dr. Gajanan Bhat, conducted testing on much thicker applications of SV-X41, which he opines resulted in swelling - and seeks preclusion as a sanction under Rule 37(c)(1). (Id. at 8.)

Application of a Rule 37 sanction depends first on a finding that a party violated Rule 26(a)'s disclosure requirements. Here, the court agrees with TieTex that it did not violate Rule 26 in not disclosing Horrocks' understanding of thermally thin coatings in his report. Horrocks' opinion is that SV-X41 does not swell when exposed to heat or flame. The basis for his opinion derives from the results of his experiments and his analysis of SV-X41's chemical components, as explained in detail in his report. (Doc. 119-2.)

Even assuming that TieTex violated Rule 26, however, the court finds that a Rule 37 sanction is not appropriate. A party who fails to "provide information or identify a witness as required by Rule 26(a)" may avoid exclusion if "the failure was substantially justified or is harmless." Fed. R. Civ. P. 37(c)(1). District courts have "broad discretion to determine whether a nondisclosure of evidence is substantially justified or harmless." S. States, 318 F.3d at 597. The Fourth Circuit has articulated five factors the court should consider when exercising this discretion:

(1) the surprise to the party against whom the evidence would be offered; (2) the ability of that party to cure the surprise; (3) the extent to which allowing the evidence would disrupt the trial; (4) the importance of the evidence; and (5) the nondisclosing party's explanation for its failure to disclose the evidence.

Id. The first four factors primarily relate to the question of harmlessness, while the fifth factor relates to a showing of

substantial justification. Id.

Before weighing the five factors, it is important to contextualize Horrocks' statements about thermally thin coatings. As demonstrated by Horrocks' deposition, PFG overstates his testimony. Horrocks defined a thermally thin coating as "one which when heated on the surface it is so thin that there is no heat gradient" and where "[t]he back of it is assumed to be the front temperature." (Doc. 119-1 at 89.) He distinguished this from a thermally thick coating, "where you have a hot surface, a cool back and you have a thermal gradient." (Id.) He explained:

Now, in a thermally thin system when you irradiate if there is any chemistry and physics going to occur it all occurs simultaneously.

In a thermally thick one it will occur at the surface and other reactions will have time, depending on their temperature rates and what have you, to take place underneath that surface. So a thick material containing a given flame-retardant will behave in many cases quite differently than a thin material.

(Id. at 90.) Horrocks distinguished this from a physically thin or thick coating. (Id. at 89.) He did not say that testing SV-X41 for swelling propensities required that he test a 45-micron-thick coating of SV-X41 due to his understanding of thermally thin coatings. Rather, he based his testing conditions on what he determined to be the typical coating thickness of SV-X41 on TieTex's fabrics. (Doc. 133 at 12-13.) Furthermore, Horrocks did not say that thermally thin coatings cannot be intumescent as a

categorical matter. Instead, after demurring to a question posed by PFG's counsel as to whether thicker SV-X41 coatings would have an impact on his expert opinion, he said:

[I]n a thermally thin [situation], which means a physically thin situation, you can have an intumescent coating behave quite differently from a thermally thick [coating]. And may not even be intumescent at all, because there is no time for the physics, this blowing process which is physics to occur as fast as or faster than the chemistry which is trying to form a char.

(Doc. 119-1 at 91 (emphasis added).) Horrocks later answered that he would not "expect" a thermally thin coating to swell. (Id. at 206.)

Horrocks was then asked if he had an opinion on the swelling capacity of a 150-micron-thick film of SV-X41 - that is, one that is physically thicker. (Id. at 214.) He responded, "I do not really have an opinion." (Id.) Referring to the testing by PFG's expert, Bhat, who tested SV-X41 at much thicker applications, Horrocks said he would "take them [Bhat's measurements from his testing] as read." (Id.) But he challenged "the model" that Bhat used and explained that even a thicker coating of nylon (which is not an intumescent) will swell and char when exposed to heat. (Id. at 214-15.) He concluded that, because nylon can exhibit intumescent properties under these circumstances, it "is relevant to the thermal thick/thin argument" and falls "into a grey area" that highlights the complexity of intumescent studies. (Id.)

Ultimately, Horrocks opined that Bhat's conclusion that SV-X41 swells is inaccurate, because he failed to take into account the "relaxation" of the fabric strains on which Bhat coated SV-X41. (Doc. 119-2 at 30-32, 34-35.) Horrocks explained that Bhat should have heated up and measured the swelling of the fabrics before applying the solution. (Id. at 32.) According to Horrocks, this practice would have allowed Bhat to isolate his analysis of SV-X41, as he could subtract any measured degree of fabric swelling when measuring for SV-X41 swelling. (Id.)

With this understanding in mind, it becomes apparent that the factors enumerated in Southern States do not favor PFG. First, it is unclear how much, if any, surprise Horrocks' opinions could have actually caused. Horrocks' expert report clearly reflected that he tested SV-X41 at a thickness of 45 microns and chose that amount because he calculated it to approximate TieTex's actual application. He noted that "the degree of swelling in any coating would be proportional either to the amount of swelling agent present or to the thickness of the coating film." (Doc. 119-2 at 33.) Opining that "the coating formulation SV-X41 does not contain a swelling agent designed to increase overall thickness," he thus put PFG on notice that the thickness of the coating film might play a role in any observations. (Id. at 33, 34.) Moreover, PFG has had ample time to respond to Horrocks' report, which was filed several months before the end of discovery. Indeed, PFG's expert,

Bhat, offered a rebuttal report challenging many of Horrocks' conclusions based on what Bhat terms an "extremely thin coating." (Doc. 114-12 at 8.) Horrocks' deposition further reflects that he had earlier mentioned in a declaration his criticism of Bhat's work because it used a thicker coating. (Doc. 119-1 at 89-92.) In addition, Horrocks' curriculum vitae listed previous publications he had authored about thermally thin coatings. (See Doc. 119-2 at 65 (citing ADVANCES IN FIRE RETARDANT MATERIALS 180 (A.R. Horrocks & D. Price eds., 2008) (discussing fire-retardant characteristics of thermally thin and thermally thick textiles); HANDBOOK OF TECHNICAL TEXTILES 247 (A. Richard Horrocks & Subhash C. Anand eds., 2000) (discussing thermally thin textiles)).³ Thus, in preparing for his expert deposition, PFG's counsel and PFG's expert witness no doubt would have been aware of Horrocks' writings on the subject.

Second, it is doubtful PFG would have done anything differently to "cure" the surprise, assuming there was any. PFG has based its argument of infringement on Bhat's testing of SV-X14 coating at an approximate thickness of 215 microns. PFG has done so because, presumably, that is the thickness it believes TieTex's coating to be. In any event, if PFG were to contend that thermally thin coatings can swell, it was never foreclosed from

³ Copies of the relevant pages were presented during the hearing on the present motions.

preparing and submitting expert testimony to that effect.

Third, permitting Horrocks' opinions would not disrupt trial. Indeed, at oral argument, PFG repeatedly argued that the thickness of the SV-X41 coating did not matter. PFG's criticism seems to be that Horrocks' use of a thermally thin coating facilitated a lesser amount of swelling that would not be easily measurable by Horrocks' use of his micrometer.

Fourth, for similar reasons and because Horrocks' testimony raises a genuine dispute as to the sole material issue remaining, the evidence is important to resolving this lawsuit.

Fifth, as noted above, TieTex presents a reasonable argument as to why it did not disclose Horrocks' understanding of thermally thin coatings before Horrocks' deposition. It is not clear that Horrocks' statements about thermally thin and thick coatings are foundational to his opinions, and in any event what was disclosed was adequate.

For all these reasons, PFG's motion to exclude Horrocks' testimony on this ground will be denied.

2. PFG's Daubert Challenge

PFG moves to exclude Horrocks' testimony as inadmissible under Federal Rule of Evidence 702 and Daubert v. Merrell Dow Pharmaceuticals, Inc., 509 U.S. 579 (1993).

Under Rule 702, an expert witness is permitted to offer opinion testimony if he "is qualified as an expert by knowledge,

skill, experience, training, or education." The witness's knowledge must help the trier of fact understand the evidence or determine a fact in issue, the testimony must be based on sufficient facts or data, the testimony must be the product of reliable principles and methods, and the witness must reliably apply the principles and methods to the facts of the case. Id. This rule "imposes a special obligation upon a trial judge to 'ensure that any and all [expert] testimony . . . is not only relevant, but reliable.'" Kumho Tire Co. v. Carmichael, 526 U.S. 137, 147 (1999) (quoting Daubert, 509 U.S. at 589). This means that Horrocks' testing methods must be both relevant to the disputed matter and reliable. Daubert, 509 U.S. at 597 ("[The] trial judge [has] the task of ensuring that an expert's testimony both rests on a reliable foundation and is relevant to the task at hand."). The court has "broad latitude" to consider any "factors bearing on validity that the court finds to be useful." EEOC v. Freeman, 778 F.3d 463, 466 (4th Cir. 2015) (quoting Westberry v. Gislaved Gummi AB, 178 F.3d 257, 261 (4th Cir. 1999)). However, "[e]xpert testimony rooted in subjective belief or unsupported speculation does not suffice." Zuckerman v. Wal-Mart Stores E., L.P., 611 F. App'x 138, 138 (4th Cir. 2015) (per curiam) (internal quotation marks omitted).⁴

⁴ Unpublished opinions of the Fourth Circuit are not precedential. See

PFG does not argue that Horrocks is not qualified. He is a chemistry professor at the University of Bolton in England (Doc. 119-1 at 8) and has over 40 years of experience studying flame-retardant materials and intumescent chemistry (Doc. 133 at 20). He has published over 200 times as to his testing of flame-retardant fabrics, including in a host of peer-reviewed journals. (Doc. 119-1 at 66-74, 256-59, 266-68). Nor does PFG argue that Horrocks' opinions are not relevant to the issue of infringement, which at this point involves whether SV-X41 swells when exposed to heat or flame. Indeed, Horrocks' testing directly analyzes and answers this question in the negative. PFG challenges the reliability of Horrocks' methods and results. (Doc. 119 at 5.)

To assess whether SV-X41 swelled when exposed to heat or flame, Horrocks applied a 45-micron-thick layer of the coating to two surfaces: a steel plate and a glass woven fabric. (Doc. 119-2 at 8-17.) He used this thickness because he concluded, based on a series of calculations, that it was the approximate thickness of SV-X41 used on TieTex fabrics. (Doc. 119-1 at 83-84.) After exposing the SV-X41-coated surfaces to heat and open flame, he concluded that, as to the steel surface and based only on his visual observation, SV-X41 did not swell. (Doc. 119-2 at 8-17.)

Collins v. Pond Creek Mining Co., 468 F.3d 213, 219 (4th Cir. 2006) (recognizing that "we ordinarily do not accord precedential value to our unpublished decisions" and that such decisions "are entitled only to the weight they generate by the persuasiveness of their reasoning" (citation omitted)).

He did, however, measure the coating applied to glass fabric. (Id. at 14.) Using an engineering-quality electronic micrometer with a movable thumbwheel that measured with an accuracy of 2.5 microns (that is, one tenth of one thousandth of an inch)⁵ (Doc. 119-1 at 30, 34, 36), he observed that the coating grew by 10 microns (to a total of 55 microns) but believed this result to be within his calculated 22 percent experimental rate of error. (Doc. 119-2 at 15-16.)

PFG argues that Horrocks' testing is unreliable because it (1) employed a thumbwheel caliper, which involved a "subjective" method of measurement; (2) improperly compared measurements of heat-exposed and non-heat-exposed regions of the tested fabrics; (3) included an ill-defined error rate that allowed him to ignore any swelling less than 22 percent of measured samples; (4) was premised on an incorrect assumption on the thickness of SV-X41 coating on TieTex fabrics; (5) failed to account for the structure of the glass fabric he used in his testing; and (6) contradicted his own research and efforts to evaluate intumescence. (Doc. 137 at 2-3, 5.)

TieTex argues that these are criticisms that affect the weight to be given Horrocks' testimony but not its admissibility. (Doc.

⁵ A micron is one thousandth of a millimeter. By comparison, the width of a human hair is 40 to 80 microns. (Doc. 133-7 at 115; Doc. 133-6 at 8 (citing ROBERT R. OGLE, JR. & MICHELLE J. FOX, ATLAS OF HUMAN HAIR: MICROSCOPIC CHARACTERISTICS 28 (1998)).)

132 at 14-18.) TieTex is correct, with one exception.

The bulk of PFG's criticisms relate to Horrocks' application of SV-X41 to glass fabric and his use of an electronic micrometer to measure for swelling. Horrocks employed glass fabrics because he believed, based on his extensive experience in testing intumescent fabrics, they would be the best substrate to allow him to test for intumescent capabilities. (Doc. 119-1 at 13-16.) He concedes that glass fabrics have an uneven surface, which could mask intumescent swelling, and that a microscopic technique would be needed to detect any swelling that may occur into any depressions in the fabric. (Id. at 33, 73, 77-78, 149-50, 160-62.) But he defends his use of a thumbwheel micrometer and the application of his error rate as necessary to ensure the accuracy of his results. (Id. at 31, 235.)

According to Horrocks, a thumbwheel micrometer is very sensitive - using a digital read-out measuring increments of 2.5 microns - and is sufficiently objective for his purposes to conduct such miniscule measurements. (Id. at 36-37, 41-42.) PFG argues that a micrometer is an unreliable device in this setting because it must be manipulated manually by turning a thumbwheel in an effort to sense resistance in measuring a substance that is flexible. (Doc. 119 at 18.) Horrocks responds that it is actually more accurate than the "standard method" of using a device with a "pressure foot" because the foot was larger than the flame surface

sought to be measured. (Doc. 119-1 at 37-38.) Thus, according to Horrocks, the micrometer can be reliably operated on these surfaces with "quite reproducible" results, and the slight variability of the results is inherent in the ordinary application of the instrument and the swelling of the fabric itself. (Id. at 41-42, 59, 77, 205, 226, 234-36.)

PFG criticizes the thickness of SV-X41 that Horrocks tested. Horrocks' testing of SV-X41 at a thickness of 45 microns differs substantially from the 215-micron thickness used by PFG's expert. Horrocks contends that the thickness he used best represented the typical thickness of SV-X41 used on TieTex fabrics. (Id. at 201-02.) Horrocks' assumed thickness was based on a series of calculations applying the average density, weight, and volume of other TieTex fabrics. (Id. at 199-202.) Horrocks criticizes the thickness used by PFG's expert as "inappropriate" and "unrealistic[]" because it simulated a "completely different" model (i.e., thicker application) than that used by TieTex in its fabrics. (Id. at 191, 194.) PFG's expert, Bhat, based his measurements on magnified photographs of TieTex fabrics. (Doc. 114 at 7-9; Doc. 114-2, ¶¶ 22, 24.)

On the current record, the court cannot say that either expert's testing is the only proper application of SV-X41 for producing reliable results, or even which expert has best approximated the application used in TieTex fabrics. PFG's images

of TieTex's SV-X41 coatings are probative, but PFG also acknowledges that TieTex "foams" its coating, increasing the thickness of the coating layer. (Doc. 119 at 7; Doc. 132 at 15.) Whether and how foaming affects intumescence qualities is unclear on this record and remains a disputed issue of fact.

Whatever the criticisms of Horrocks' techniques in performing his measurements (Doc. 119-1 at 5, 16-18), it is clear that his methods of testing flame-retardant fabrics have been peer-reviewed and published approximately 200 times (id. at 66-74, 256-59, 266-68). Apart from his use of a micrometer rather than a device with a pressure foot and his decision to measure different areas of the fabric after exposure to heat, it is not clear that his method differed so substantially from prior methods as to render his results unreliable. Horrocks confirmed that he used a similar method of coating and drying SV-X41 as he did in past testing of intumescent fabrics. (Id. at 99.) He also explained that many of the techniques that PFG cites in its criticism of his testing concerned different types of fabrics and coatings and were therefore not appropriate when testing SV-X41. (Id. at 64-65, 267-69.) He defended his methodology of testing heat-exposed and unexposed areas of the glass fabric on the grounds that the mere testing of the fabric (i.e., before exposing to heat or flame) "itself can change the results of what you are trying to measure" and lead to unreliable results. (Id. at 180.)

Horrocks also explained how he calculated his experimental rate of error. His testing involved coating glass fabric samples with SV-X41 before exposing them to heat. (Doc. 119-1 at 160-77, 234-37; 258, 260-62.) He used the electronic micrometer to measure the thickness on each surface eight times. (Id.) He rounded his measurements to the nearest hundredth of a millimeter, rounding down if the caliper recorded a measurement of five thousandths of a millimeter (i.e., a measurement of .365 millimeters was recorded as .360). (Id. at 37, 75-77.) Horrocks then added these sixteen measurements (Doc. 119-2 at 14-15) and divided the sum by sixteen to calculate an average measurement. (Doc. 119-1 at 160-77, 234-37; 258, 260-62.) He then calculated the differences between his 16 measurements and the mean. (Id.) He added those figures and divided them by 16 to calculate the average deviation in his measurements, equaling .02 millimeters, or 20 microns. (Id.) Because the coated fabric Horrocks used in his testing was 45 microns thick, he divided his average measurement deviation, 20, by 45, producing a 44 percent difference. (Id.) This 44 percent figure became his rate of error in measuring unexposed samples of SV-X41. (Id.) He used the same method to calculate his rate of error when measuring heat-exposed samples of SV-X41, finding an average measurement deviation of .01 millimeters, or 10 microns. (Id. at 162-64.) Divided by 45, this equaled 22 percent, reflecting a 22 percent error rate for his measurement of charred

regions. (Id. at 162-64, 167-68.)

Horrocks explained that these error rates reflect "composite[s] of human error and technical error, the error in making those readings." Id. at 260-61.) He also noted that his error rates reflected the error-prone nature inherent in measuring such thin coatings:

[T]he measurements they are quite error prone, but combined with the other evidence this is not a swelling material. When it is at the thickness of the thickness that it is in the Tietex fabrics, which is 50 microns or less, it is - you have to take all the evidence together. It is a typical - of any scientific conclusion. You do not use one technique to prove something. You use a number of techniques. Some are semi-qualitative. Some are quantitative. Some are semi-quantitative. So taking it on balance there is no swelling property in a film - in this coating for a film of that thickness.

(Id. at 172.)

Horrocks opined that his methodology in calculating his error rate would not be criticized in peer-reviewed journals in his area of applied polymer science. (Id. at 258-59.) Moreover, PFG's expert, Bhat, did not criticize Horrocks' calculation of it. Bhat also conceded that the practice of calculating and using an error rate when conducting scientific tests is "widely used," despite not calculating or applying an error rate in his own testing. (Doc. 133-10 at 147, 151.) Bhat also agreed that, assuming Horrocks' error rate was accurately calculated, his testing

revealed that SV-X41 did not swell when exposed to heat. (Doc. 133-10 at 150-52, 168-69.)

The court is satisfied that Horrocks' calculated rate of error meets the third factor under Daubert. Daubert, 509 U.S. at 593-94. Horrocks has calculated his error rate by way of "scientific studies, [and] not by assumption." United States v. Crisp, 324 F.3d 261, 274 (4th Cir. 2003). While PFG criticizes Horrocks' calculation and application of his error rate, (Doc. 119 at 19-20), "[t]he potential rate of error need not be completely accurate," but based on sufficient evidence. Banks v. United States, 75 Fed. Cl. 294, 301 (2007). PFG's disagreements with Horrocks' potential rate of error are therefore insufficient to exclude his testimony at this stage. Id.

Moreover, Horrocks made use of standards and controls when conducting his experiments. When measuring SV-X41 for swelling, he compared sections of SV-X41 that were exposed to heat with control specimens that were not. (Id. at 138, 151-52.) He also used surfaces and flame sources that complied with standards commonly used when testing textiles. (Id. at 15, 27-29.) Finally, his method also appears to enjoy "general acceptance" within his relevant community, based on its having been extensively published and approved in peer-reviewed articles. (Id. at 66-74, 256-59.) Notably, the inventors of PFG's patented fabrics submitted several references of Horrocks' work in applying for the patents in

question, indicating some respect for Horrocks' studies in the field of intumescent technology. (Doc. 32 at 19.)

Daubert calls for courts to assess the evidentiary reliability of scientific evidence "based upon scientific validity." Daubert, 509 U.S. at 590 n.9 (emphasis in original). Scientific validity asks, "Does the principle support what it purports to show?" Id. In this case, as to the testing on glass fabrics the answer appears to be yes. Horrocks' testing methods support their ultimate purpose - to determine whether SV-X41 swells when exposed to heat. In this respect, PFG's motion is something short of a "true Daubert challenge," as it fails to argue that Horrocks' methodology has no standards for application, cannot be replicated, and has not been peer-reviewed. TFWS, Inc. v. Schaefer, 325 F.3d 234, 240 (4th Cir. 2003) ("TFWS does not mount a true Daubert challenge, for it does not argue that these methods have not been tested, have not withstood peer review and publication, have excessive rates of error, have no standards for their application, or have not been accepted in their field.")

Assessing the credibility and weight of the testimony is the role of the jury. "Vigorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence." Daubert, 509 U.S. at 596; see United States v. Baller, 519 F.2d 463, 466 (4th Cir. 1975) ("Unless an

exaggerated popular opinion of the accuracy of a particular technique makes its use prejudicial or likely to mislead the jury, it is better to admit relevant scientific evidence in the same manner as other expert testimony and allow its weight to be attacked by cross-examination and refutation."). While Horrocks' testing methods differ from Bhat's, his results are not inadmissible. Heller v. Shaw, Inc., 167 F.3d 146, 160 (3d Cir. 1999) (expert testimony cannot be excluded simply because the expert uses one test rather than another, when both tests are accepted in the field and both reach reliable results); see also United States v. Bonds, 12 F.3d 540, 562 (6th Cir. 1993).

For all these reasons, PFG's motion to exclude Horrocks' testimony concerning his testing and measuring of SV-X41 on glass fabrics will be denied.

Horrocks' testimony as to his tests of SV-X41 on steel surfaces, however, rests on a different footing. In particular, Horrocks' opinion that he found no swelling is based on his unaided visual observation. (Doc. 119-1 at 15-16.) During his deposition, Horrocks defended this methodology by stating that he can observe swelling occurring at 5 to 10 microns - a nearly microscopic level, which are at levels significantly smaller than the width of a human hair. (Id. at 114-18.) There are two problems with this testimony.

First, it strains credulity to believe that anyone can measure near microscopic swelling of a 45-micron sized film. Second, even if Horrocks has such extraordinary vision, in this context its use is not proven to produce reliable results. Ruffin v. Shaw Indus., Inc., 149 F.3d 294, 299 (4th Cir. 1998) (excluding the testimony of the plaintiff's expert on Rule 702 grounds because "[n]o organization, public or private, has been able to independently obtain consistent findings using the techniques employed by" the expert and his equipment). In some instances visual observation could produce a reliable result (such as when something changes color), but here Horrocks' testimony is no more than an *ipse dixit* declaration unsupported by testable, reliable science. Durkin v. Equifax Check Servs., Inc., 406 F.3d 410, 420-22 (7th Cir. 2005) (excluding expert testimony as "untestable say-so"); BASF Corp. v. Sublime Restorations, Inc., 880 F. Supp. 2d 205, 212-14 (D. Mass. 2012) (holding that an expert "eyeballing" the products at issue in a breach of contract case produced "an unknown error rate" and lacked reliability); R.F.M.A.S., Inc. v. So, 748 F. Supp. 2d 244, 282-83 (S.D.N.Y. 2010) (excluding expert testimony that was "little more than conclusory say-so"); United States v. Frabizio, 445 F. Supp. 2d 152, 159 (D. Mass. 2006) (excluding expert's testimony distinguishing between real and digitally altered images because his methodology of visual observation was unreliable).

The court will therefore grant PFG's motion to exclude Horrocks' testimony to the extent it is founded solely on his visual observations as to quantitative swelling on the SV-X41 tested on steel surfaces. Kumho Tire Co. v. Carmichael, 526 U.S. 137, 154-56 (1999) (finding expert's testimony based on "simple visual-inspection methodology" unreliable and therefore inadmissible).⁷

B. PFG's Motion for Partial Summary Judgment

Summary judgment is appropriate where the pleadings, affidavits, and other proper discovery materials demonstrate that no genuine dispute as to any material fact exists and the moving party is entitled to judgment as a matter of law. Fed. R. Civ. P. 56(a); Celotex Corp. v. Catrett, 477 U.S. 317, 322-33 (1986). The party seeking summary judgment bears the burden of initially demonstrating the absence of a genuine dispute as to any material fact. Celotex, 477 U.S. at 323. If this burden is met, the nonmoving party must then affirmatively demonstrate a genuine dispute of material fact which requires trial. Matsushita Elec. Indus. Co. v. Zenith Radio Corp., 475 U.S. 574, 587 (1986). There

⁷ PFG does not challenge, and the court therefore does not address, Horrocks' other testimony about visual observations related to the testing in this case. (See, e.g., Doc. 119-1 at 169-70 (the "very intensely observable warp and weft" he claims can be seen in a swelling fabric), at 170 (three dimensional swelling he argues would be observable such that "the pores in the fabric would [be] filled"), and at 171 (describing the obliteration of underlying fabric structure in swelling material).)

is no issue for trial unless sufficient evidence favoring the nonmoving party exists for a factfinder to return a verdict for that party. Anderson v. Liberty Lobby, Inc., 477 U.S. 242, 249-50, 257 (1986). In addition, the nonmoving party is entitled to have the "credibility of his evidence as forecast assumed, his version of all that is in dispute accepted, [and] all internal conflicts in it resolved favorably to him." Metric/Kvaerner Fayetteville v. Fed. Ins. Co., 403 F.3d 188, 197 (4th Cir. 2005) (quoting Charbonnages de France v. Smith, 597 F.2d 406, 414 (4th Cir. 1979)) (initial quotation marks omitted).

1. TieTex Counterclaim Alleging Patent Invalidity

Counts III and IV of TieTex's counterclaim against PFG seek a declaration that the '639 and '162 patents are "invalid pursuant to one or more of the provisions of 35 U.S.C. §§ 102, 103 and/or 112." (Doc. 32 at 14-15.) The allegations are conclusory and are bereft of any factual support. PFG argues that summary judgment is appropriate because an invalidity claim requires expert opinion and TieTex never declared an expert or served an expert report in support of its claim. (Doc. 114 at 19-20.) TieTex responded that the claim was moot because it had put the question of invalidity before the Patent Trial and Appeal Board ("PTAB") and was awaiting a decision. (Doc. 133 at 25-26.)

To prevail on these claims, TieTex must demonstrate invalidity with clear and convincing evidence, as issued patents

enjoy a presumption of validity. 35 U.S.C. § 282; U.S. Surgical Corp. v. Ethicon, Inc., 103 F.3d 1554, 1564 (Fed. Cir. 1997). Because this is an equitable claim, its resolution is ultimately for the court. Ross Coal Co. v. Cole, 249 F.2d 600 (4th Cir. 1957).

TieTex's arguments to avoid summary judgment are unavailing. Its contention that the issue of validity is moot due to a then-pending challenge before the PTAB is factually incorrect and was so when the contention was made. By the time TieTex filed its response brief, the PTAB had rendered its final decision, rejecting every challenge by PFG to the '639 patent. (Doc. 138-1.) At the hearing on these motions, TieTex conceded that it was estopped from arguing invalidity on the basis of three references (known as Rowan, Murch, and Radwanski) pursuant to 35 U.S.C. § 315(e)(2). But TieTex maintained that it was not estopped from arguing invalidity on the basis of three other references (known as Külper, Rowan, and Horrocks), as the PTAB did not address these references in its final decision. (See Doc. 138-1.) However, 35 U.S.C. § 315(e)(2) estops TieTex from asserting that the '639 patent is invalid not only on grounds raised during the inter partes review, but also on grounds that "reasonably could have [been] raised" during the inter partes review.⁸ TieTex is therefore foreclosed

⁸ A party seeking an inter partes review is limited to arguing invalidity

from asserting the invalidity of the '639 patent during this proceeding. SAS Inst., Inc. v. ComplementSoft, LLC., 825 F.3d 1341, 1351 (Fed. Cir. 2016). The PTAB also denied TieTex's petition to commence an inter partes review of PFG's challenges to all claims of the '162 patent. (Doc. 138-2.) The estoppel provisions of 35 U.S.C. § 315(e)(2) do not apply to a denial of an inter partes review. But the PTAB's refusal to institute an inter partes review is indicative of the weakness of TieTex's claim of invalidity as to the '162 patent, as the PTAB will not authorize an inter partes review unless "there is a reasonable likelihood" that a petitioner would prevail in proving invalidity. 35 U.S.C. § 314(a); Husky Injection Molding Sys. Ltd. v. Athena Automation Ltd., 838 F.3d 1236, 1246 (Fed. Cir. 2016).

Moreover, TieTex's claims fail on the merits. TieTex argues that PFG should not have been granted the patents at issue because PFG's fabrics comprised prior art elements, the combination of

on the grounds that the patent in question is not novel or would be obvious to a person of ordinary skill in the art to which the claimed invention pertains. 36 U.S.C. § 311(b). TieTex could not, therefore, argue invalidity on the basis of inequitable conduct in its inter partes review, so the estoppel provisions of 35 U.S.C. § 315(e)(2) do not apply to TieTex's counterclaim of inequitable conduct. Conair Corp. v. Tre Milano, LLC, No. 3:14-CV-1554 AWT, 2015 WL 4041724, at *3 (D. Conn. July 1, 2015); Arlington Indus., Inc. v. Bridgeport Fittings, Inc., No. 3:CV-06-1105, 2008 WL 2595106, at *3 (M.D. Pa. June 27, 2008), vacated in part on other grounds by 2009 WL 364937 (2009) ("[T]he PTO will only examine the validity of the '831 Patent based upon prior art, and will not consider other grounds of invalidity or unenforceability, such as inequitable conduct.") That counterclaim is addressed separately in this opinion.

which would have been obvious to a person of ordinary skill at the time of the invention. If true, PFG's patents would be invalid under 35 U.S.C. § 103. Senju Pharm. Co. v. Lupin Ltd., 780 F.3d 1337, 1341 (Fed. Cir. 2015) (stating that "a defendant asserting obviousness in view of a combination of references has the burden to show that a person of ordinary skill in the relevant field had a reason to combine the elements in the manner claimed" (quoting KSR Int'l Co. v. Teleflex, Inc., 550 U.S. 398, 418 (2007))). However, proof of obviousness in a complex area of fire retardants, chemistry, and textiles would require expert testimony. See INVISTA N. Am. S.A.R.L. v. M&G USA Corp., 951 F. Supp. 2d 626, 651-52 (D. Del. 2013). As PFG points out, TieTex never disclosed an expert on this issue.

In an effort to overcome this default, TieTex now seeks to rely on its submission to the PTAB, which includes an affidavit from Horrocks, all of which TieTex has attached to its response brief on the present motion. (Docs. 133-11, 133-12.) As PFG argues, this is not a proper disclosure of expert evidence under Federal Rule of Civil Procedure 26(a)(2)(B), however. Russell v. Absolute Collection Servs., Inc., 763 F.3d 385, 396-98 (4th Cir. 2014) (affirming district court's exclusion of expert testimony for a failure of disclosure). Moreover, TieTex's failure to have properly identified Horrocks for this claim was neither substantially justified nor harmless. If the court were to

construe Horrocks' affidavit as an expert disclosure, its lateness after discovery has closed would constitute surprise to PFG that will be very difficult to cure without retaining a further expert to rebut it. This would require reopening discovery and delay the proceedings. That the evidence is important to TieTex's claim renders it even more curious why TieTex has no reasonable explanation for not having prepared for the possibility of the PTAB ruling against it. A careful consideration of all these factors leads the court to decline to excuse the disclosure violation. S. States, 318 F.3d at 597.

As a result, TieTex has not made a showing from which the court could find liability by clear and convincing evidence. PFG's motion for summary judgment as to invalidity will therefore be granted, and Counts III and IV of the counterclaim will be dismissed.

2. TieTex Counterclaim Alleging Inequitable Conduct

Count V⁹ of TieTex's counterclaim seeks a declaratory judgment that PFG's patents are invalid because PFG engaged in inequitable conduct during their prosecution. (Doc. 32 at 15-20.) TieTex alleges that the inventors of both patents "failed to disclose, and deliberately withheld, information from the [United States

⁹ The counterclaim has two counts labeled "V." They are identical except that the first addresses the '639 Patent and the second addresses the '162 Patent. The second count is obviously mislabeled.

Patent and Trademark Office ("USPTO")] that they knew was material to patentability of the '639 [and '162] patent." (Id. at 16, 18.) For each allegation, TieTex lists six references (four articles and two patents) that it believes were deliberately withheld from the USPTO. (Id.)

To prove PFG's inequitable conduct, TieTex "must prove by clear and convincing evidence both of the 'separate requirements' that: (1) 'the patentee acted with the specific intent to deceive the PTO'; and that (2) the non-disclosed reference was 'but-for material.'" 1st Media, LLC v. Elec. Arts, Inc., 694 F.3d 1367, 1372 (Fed. Cir. 2012) (citing Therasense, Inc. v. Becton, Dickinson & Co., 649 F.3d 1276, 1290-92 (Fed. Cir. 2011) (en banc)). Moreover, the specific intent to deceive must be "the single most reasonable inference able to be drawn from the evidence." Therasense, 649 F.3d at 1290 (quoting Star Sci., Inc. v. R.J. Reynolds Tobacco Co., 537 F.3d 1357, 1366 (Fed. Cir. 2008)). "A finding that the misrepresentation or omission amounts to gross negligence or negligence under a 'should have known' standard does not satisfy this intent requirement." Id. at 1290 (citing Kingsdown Med. Consultants, Ltd. v. Hollister Inc., 863 F.2d 867, 876 (Fed. Cir. 1988)). And, when "there are multiple reasonable inferences that may be drawn, intent to deceive cannot be found." Id. at 1290-91.

TieTex argues that materiality is evident from the fact that

the PTAB entertained TieTex's inter partes review of the '639 Patent based on three of the six references - Rowan, Radwanski, and Murch (Doc. 138-1 at 6) - and because TieTex believes that the PTAB may institute an inter partes review of the '162 Patent on the same basis (Doc. 133 at 26). In advancing its arguments during claim construction, TieTex cited one of these references to argue how a person of ordinary skill would define the term "intumescent." (Doc. 57 at 18-19.) TieTex also argued that the patent examiner would not have issued the '639 patent if she had been aware of that undisclosed patent at the time of issue. (Doc. 41 at 18 n.8.)

Of course, the PTAB rejected TieTex's obviousness arguments as to the prior patents in the inter partes review of the '639 Patent. The PTAB not only refused to institute an inter partes review as to the '162 Patent on these same grounds, but all six references TieTex cites in its counterclaim were submitted to the USPTO by the inventors during PFG's prosecution of the '162 patent and appear on its face (Doc. 114 at 21); the '162 Patent was issued despite the prior patents (Doc. 112-2).

TieTex nevertheless contends that, while the references were disclosed in the '162 Patent, it is invalid as a continuation of the '639 Patent under the doctrine of unclean hands. See, e.g., Consol. Aluminum Corp. v. Foseco Int'l Ltd., 910 F.2d 804, 809 (Fed. Cir. 1990) (finding that inequitable conduct in prosecution of one patent "infect[ed]" subsequently procured patent under the

unclean hands doctrine, as there was an "immediate and necessary relation" between the earlier inequitable conduct and the equity the patent holder sought in enforcing the second patent). But TieTex has failed to proffer sufficient evidence from which the court could find specific intent to deceive the USPTO as to the '639 Patent. "Because direct evidence of deceptive intent is rare, a district court may infer intent from indirect and circumstantial evidence." Therasense, 649 F.3d at 1290 (citing Larson Mfg. Co. of S.D., Inc. v. Aluminart Prods. Ltd., 559 F.3d 1317, 1340 (Fed. Cir. 2009)). However, "the evidence 'must be sufficient to require a finding of deceitful intent in the light of all the circumstances.'" Id. (quoting Kingsdown, 863 F.2d at 873). "Hence, when there are multiple reasonable inferences that may be drawn, intent to deceive cannot be found." Id. at 1290-91 (citing Scanner Techs. Corp. v. ICOS Vision Sys. Corp., 528 F.3d 1365, 1376 (Fed. Cir. 2008) ("Whenever evidence proffered to show either materiality or intent is susceptible of multiple reasonable inferences, a district court clearly errs in overlooking one inference in favor of another equally reasonable inference.")).

Here, TieTex deposed two of the three inventors on the patents in question. In early 2000, one inventor, Larry Fraser, received certain reports from "NERAC," a research and advisory firm, when trying to learn more about intumescent. (Doc. 112-8 at 8-9.) The reports contained the titles and descriptions of six references

TieTex now claims were intentionally withheld from the USPTO. (Doc. 114 at 20; Doc. 133 at 16.) There is some evidence that NERAC may have sent a copy of one of the references - the Rowan patent - to Fraser in March 2000, but there is no evidence that he received it or that it was in his file. (Doc. 133-16 at 3-7; 133-19 at 4.) The other inventor, Vincent Monfalcone, III, testified that he had no recollection of ever having seen the references. (Doc. 112-9 at 6-7.) The third inventor was never deposed.

In a short paragraph, TieTex argues that this circumstantial evidence supports the inference "that at least one of the inventors knew of [the] Rowan [patent] and actually asked for a copy," thus providing "enough [evidence] to allow the Court to 'infer intent from indirect and circumstantial evidence.'" (Doc. 133 at 26.) "The law is clear that 'inequitable conduct requires not intent to withhold, but rather intent to deceive. Intent to deceive cannot be inferred simply from the decision to withhold [information] where the reasons given for the withholding are plausible." Astrazeneca Pharm. LP v. Teva Pharm. USA, Inc., 583 F.3d 766, 770, 777 (Fed. Cir. 2009) (quoting Dayco Products, Inc. v. Total Containment, Inc., 329 F.3d 1358, 1367 (Fed. Cir. 2003)). Here, it is not even apparent that TieTex ever had a copy of the references. TieTex fails to point to any portion of Fraser's testimony to suggest that he intentionally withheld these references. Taken together, the record lacks sufficient evidence

from which "the single most reasonable inference" is that PFG made a "deliberate decision to withhold a known material reference." See 1st Media, 694 F.3d at 1372, 1374 (emphasis omitted).

All of this is consistent with TieTex's candid concession at the claim construction hearing in these cases in December 2014 (after the aforementioned depositions of the two inventors) that it lacked evidence that PFG ever had a copy of the Rowan patent. (Doc. 56 at 131:8-22 ("We don't have any evidence yet that they actually had the full copy of Rowan in front of them . . . but if we can find that evidence, we'll certainly present it to the Court and make an inequitable conduct argument").) To date, no additional evidence has been submitted on this claim. Consequently, there is no genuine dispute of material fact as to the allegedly inequitable conduct of PFG, and PFG's motion for summary judgment on both Count Vs of the counterclaim will be granted. Optium Corp. v. Emcore Corp., 603 F.3d 1313, 1319-20, 1322 (Fed. Cir. 2010) (affirming district court's grant of summary judgment of no inequitable conduct where party claiming inequitable conduct failed to proffer sufficient evidence from which to infer a deliberate decision to mislead the patent examiner by clear and convincing proof of an allegedly "highly material" reference).

3. PFG Claim of Patent Infringement

a. Literal Infringement

Counts I and II of PFG's complaint allege that TieTex infringes PFG's '162 and '639 patents by making, offering, and selling fabrics that are covered by the patents' claims, in violation of 35 U.S.C. § 271. (Doc. 29 at 4-6.) Determining infringement involves a two-step analysis. Carroll Touch, Inc. v. Electro Mech. Sys., Inc., 15 F.3d 1573, 1576 (Fed. Cir. 1993). First, a court must construe the claim at issue in order to determine its scope and meaning. Id. Second, the court must compare the claim to the alleged infringer's products. Id.; see also ZMI Corp. v. Cardiac Resuscitator Corp., 844 F.2d 1576, 1578 (Fed. Cir. 1988). Literal infringement is found if the accused products embody every limitation of the claim. Carroll Touch, 15 F.3d at 1576.

The court has previously construed the claims, and TieTex has conceded that all of the claim limitations set forth in PFG's patents are "present literally" in its fabrics, with the exception that its products are not treated with an "intumescent finish," defined as "a substance that swells and chars upon exposure to heat or flame." (Doc. 112-5; Doc. 112-6.) Because TieTex has conceded that its coating "chars" when exposed to heat or flame (Doc. 133 at 7), the sole disputed issue is whether SV-X41 swells when exposed to heat or flame, as the parties agree (Doc. 114 at

5; Doc. 133 at 7). Thus, for the court to grant PFG's motion for summary judgment, PFG must show that TieTex has failed to proffer sufficient facts to raise a genuine dispute that SV-X41 swells when exposed to heat or flame. PFG's motion relies on both the evidence of its expert, Bhat, that SV-X41 swells when exposed to heat and flame (Doc. 119-5 at 36-38), and its argument that the testimony of Tietex's expert, Horrocks, who concluded to the contrary, should be excluded. For the reasons stated above, however, the court has declined to exclude most of Horrocks' report and testimony.

In light of the court's denial of the motion to exclude Horrocks' testimony, it is clear that Horrocks provides sufficient evidence that, if believed by the trier of fact, would support the conclusion that SV-X41 does not swell when exposed to heat or flame. As detailed in the court's discussion as to PFG's motion to exclude Horrocks' testimony, Horrocks testified that his testing reveals no measurable swelling of SV-X41 on an inert glass substrate. Whether he tested an appropriate thickness of SV-X41 and whether his testimony is to be believed remain questions of fact that cannot be decided at this stage. In addition, TieTex relies on Horrocks' testimony as to how SV-X41's chemical composition prevents any swelling. (Doc. 132 at 17.) As Horrocks stated in his report, "Based on my expertise and understanding of the chemistry behind intumescent, it is my opinion that the

individual components [of SV-X41], either alone or in combination, would not be expected to swell upon exposure to heat or flame." (Doc. 119-2 at 7.)

PFG does not argue that Horrocks is not qualified to assess SV-X41's chemistry. Instead, it criticizes Horrocks for allegedly stating only his "expectation" rather than an opinion based on SV-X41's actual reaction to heat or flame. (Doc. 135 at 8-9.) This is unpersuasive. Horrocks' statements set forth his expert opinion, based on his extensive experience with intumescent fabrics, his understanding of the chemistry of SV-X41, and his experiments conducted on samples of the coatings. This is a disputed fact, as PFG relies on its expert, Bhat, who opines that he would expect SV-X41 to swell based on a chemical analysis because it contains components that release gas when exposed to heat and therefore expand. (Doc. 133-6 at 22-23.)

PFG argues that Bhat's testimony as to the swelling he observed is unrebutted. (Doc. 135 at 4.) But Horrocks' opinion, if believed, would also rebut Bhat's testimony in at least two ways. First, Horrocks opines that, based on his understanding of the chemistry of SV-X41 and fabrics under heat and flame, what Bhat claims is swelling is actually the "relaxing" of the fabric that causes it to thicken, and not the SV-X41. (Doc. 119-2 at 30-32.) Second, Horrocks' opinion as to the chemical composition of SV-X41 would explain why any swelling Bhat claims to have observed

cannot be attributed to the coating. (Id. at 7.)

Based on the record evidence, a reasonable jury could find that SV-X41 cannot and does not swell because of its chemical makeup and Horrocks' testing results showing no swelling beyond a calculated rate of error. Anderson, 477 U.S. at 248 (summary judgment will not be granted where "the evidence is such that a reasonable jury could return a verdict for the nonmoving party"). "While a non-movant cannot defeat summary judgment with merely a scintilla of evidence," Am. Arms Int'l v. Herbert, 563 F.3d 78, 82 (4th Cir. 2009) (citation omitted), TieTex's evidence is sufficient to defeat PFG's motion for summary judgment. It is not "merely colorable" but is "significantly probative." Id. at 249-50. Whether it is to be believed is for the factfinder to determine.¹¹

¹¹ TieTex also relies on the testimony of Holland of Royal Adhesives, the maker of SV-X41. (Doc. 133 at 8.) In his deposition, Holland explained, among other things, that SV-X41 was "never designed to [swell] and hasn't performed that way either." (Doc. 114-7 at 25.) According to Holland, SV-X41 "doesn't swell by observation" but becomes a "white powder" under heated conditions that "doesn't spread out or swell" yet "snuffs the flame immediately on the site." (Id. at 23, 25-26.) He based his statements on both visual inspection and chemical analysis, noting that SV-X41's chemical composition (e.g., aluminum trihydrate) prevents it from swelling. (Id. at 25-26.)

PFG urges the court to disregard Holland's statements as "not credible," to the extent Holland is testifying as to his visual observation of an almost-microscopic effect, and as undisclosed expert opinion, to the extent he describes the chemical performance of SV-X41. (Doc. 135 at 7 & n.4.) As to the former, it is the court's role on summary judgment to assess whether a genuine dispute exists, not whether proffered evidence is credible. Reeves v. Sanderson Plumbing Prods., 530 U.S. 133, 150 (2000). As with Horrocks' testimony as to testing on

For these reasons, PFG's motion for summary judgment on the issue of infringement will be denied.

b. Doctrine of Equivalents

PFG argues in the alternative that even if SV-X41 is not an intumescent within the meaning of the patents in suit, TieTex's products nevertheless infringe under the doctrine of equivalents. (Doc. 114 at 18.) PFG advances two arguments. First, it argues that even if SV-X41 is not a "'true' intumescent," Bhat opines that TieTex's fabrics perform substantially the same function in substantially the same way with substantially the same result as the claims of PFG's patents. (Id. at 18-19.) That is, PFG argues, Bhat's testing demonstrates that TieTex's products swell when exposed to heat or flame, and TieTex has not performed any tests on its products to rebut that conclusion. (Id. at 18.) Second, PFG claims that TieTex has admitted that it coats its products with a "char-forming finish," citing Holland's description of SV-

steel surfaces, however, the court need not credit testimony that is manifestly incredible. Jarman v. Philadelphia-Detroit Lines, 131 F.2d 728, 730 (4th Cir. 1942) (noting that "evidence may be completely disregarded as without probative force if it is manifestly incredible when tested by accepted physical laws in the light of incontrovertible facts"). Holland's familiarity with his company's product and observation of the operation of SV-X41 as applied to various fabrics may permit him to provide relevant fact witness testimony - e.g., as to SV-X41's chemical makeup. But TieTex's failure to identify him as an expert puts the admissibility of any opinions as to SV-X41's chemical performance at issue. Because TieTex has proffered sufficient evidence otherwise to oppose PFG's motion for summary judgment, the court need not consider Holland's evidence for purposes of the present motion, leaving whether and to what extent Holland's specific testimony should be admissible for the trial court to determine.

X41 forming an "intumescent char" and a "thermal insulation barrier." (Id. at 19.) PFG also notes Horrocks' statement that he would expect the composition of SV-X41 "to contribute to the finish intumescing upon exposure to heat or flame," creating "an interactive finish and fiber composition." (Id.) TieTex acknowledges the arguments but responds by relying on its evidence that SV-X41 does not swell. (Doc. 133 at 18.)

The parties agreed at the hearing on these motions that the proper test for assessing infringement is the "function-way-result" test. Graver Tank & Mfg. Co. v. Linde Air Prod. Co., 339 U.S. 605, 608 (1950). Under the function-way-result test, an accused element is equivalent to a claim limitation "if it performs substantially the same function in substantially the same way to obtain the same result." Id.; see also Warner-Jenkinson Co. v. Hilton Davis Chem. Co., 520 U.S. 17, 38 (1997). To find equivalence, all three prongs must be met.

Here, the parties agree that the functionality and results of TieTex's products are substantially the same as the claims: they adopt flame-retardant capabilities when exposed to heat or flame by forming a thermal insulation barrier. TieTex also concedes that its fabrics satisfy all other limitations of the asserted claims, with the exception that its fabrics were not treated with an "intumescent" finish, as defined in PFG's patents. (Doc. 114 at 5; Doc. 133 at 7.) Thus, the sole focus of the inquiry turns

on the way in which TieTex's product operates when exposed to heat or flame. For the reasons set forth below, both of PFG's arguments fail.

In general, the Federal Circuit has restricted the application of the doctrine of equivalents since courts began to apply it in equity. Tex. Instruments, Inc. v. U.S. Int'l Trade Comm'n, 805 F.2d 1558, 1572 (Fed. Cir. 1986) ("The determination of equivalency by its nature is inimical to the basic precept of patent law that claims are the measure of the grant."); Fairfax Dental (Ireland) Ltd. v. Sterling Optical Corp., 808 F. Supp. 326, 335-36 (S.D.N.Y. 1992). The Federal Circuit has also advised caution in applying the doctrine of equivalents, reminding courts that it is the terms of the claims, and not the products themselves, that are the focus of the inquiry. Read Corp. v. Portec, Inc., 970 F.2d 816, 822 n.2 (Fed. Cir. 1992) ("For example, a pen and a pencil may for many purposes or uses be generally equivalent, but claim limitations drawn to a pen would not under the doctrine of equivalents cover a pencil and *vice versa*."), superseded on other grounds as recognized by Markman v. Westview Instruments, Inc., 52 F.3d 967 (Fed. Cir. 1995).

This has led courts to deny claims for infringement under the doctrine of equivalents, even when the products in question seem exceedingly similar. See Hill-Rom Co. v. Kinetic Concepts, Inc., 209 F.3d 1337 (Fed. Cir. 2000) (no infringement in case involving

hospital beds, because defendant's beds used cushions that were used to rotate patients as opposed to "comfort" and "support," as "cushion" was defined in the patents in question); Kemco Sales, Inc. v. Control Papers Co., 208 F.3d 1352 (Fed. Cir. 2000) (no infringement in case involving secure envelopes where envelopes closed in "substantially different" ways, with one envelope closing by way of a flap folding over, while the other closed using a dual-lip structure with a binding adhesive); Chiuminatta Concrete Concepts, Inc. v. Cardinal Indus., Inc., 145 F.3d 1303 (Fed. Cir. 1998) (no infringement in case involving concrete saws, where one product used wheels that rolled over the concrete while the other used a flat plate that "skids" over the concrete); Atlanta Motoring Accessories, Inc. v. Saratoga Tech., Inc., 33 F.3d 1362 (Fed. Cir. 1994) (no infringement because accused party's automobile luggage racks were shaped differently from patentee's claims and therefore operated in a substantially different way, despite performing the same function with the same result); Read Corp., 970 F.2d at 822 n.2 (discussing the possible hazards of the doctrine of equivalents, where "laymen may be led to comparison of devices, rather than between the accused device and the claim, and to rely on generalities in the overall purpose of the devices").

PFG's first argument for infringement under the doctrine of equivalents focuses on the performance of TieTex's coated fabric. But PFG's focus on TieTex's fabrics, as opposed to the finish on

those fabrics, is misplaced. The claims of the patents at issue relate to an intumescent finish. (See Doc. 112-1 at 9, claim 12 (“wherein the non-woven substrate is treated with a finish comprising an intumescent, flame retardant coating”).) PFG vigorously argued against a claim construction that defined an “intumescent system,” which would have been a definition that included more than just the solution coated on PFG’s fabrics. (Doc. 36 at 15-18.) Indeed, the court defined “intumescent” as “a substance that swells . . . when exposed to heat or flame” at PFG’s urging. (Doc. 57 at 20-21.) By advancing the argument that the meaning of this term is insubstantial, PFG contradicts its own earlier position: “it is PFG’s position – as well as a long-standing and settled legal principle – that claim elements should not be ignored.” (Doc. 46 at 9.)

The court cannot apply the function-way-result test so as to vitiate a term used in the accusing party’s patent. Ethicon Endo-Surgery, Inc. v. U.S. Surgical Corp., 149 F.3d 1309, 1320 (Fed. Cir. 1998); Pennwalt Corp. v. Durand-Wayland, Inc., 833 F.2d 931, 935 (Fed. Cir. 1987) (en banc) (“The claim limitations, however, require the performance of certain specified functions.”), abrogated on other grounds by Cardinal Chem. Co. v. Morton Int’l, 508 U.S. 83 (1993); see also Vehicular Techs. Corp. v. Titan Wheel Int’l, Inc., 141 F.3d 1084, 1090 (Fed. Cir. 1998) (“[I]f a claim limitation must play a role in the context of the specific claim

language, then an accused device which cannot play that role, or which plays a substantially different role, cannot infringe under the doctrine of equivalents. The question of whether an explicit function has been identified with a claim limitation entails an examination of the claim and the explanation of it found in the written description of the patent.") Granting PFG summary judgment on the issue of infringement under the doctrine of equivalents would require a finding that the way in which TieTex's fabrics allegedly combat fire - by becoming a white powder that snuffs out flame immediately, without swelling - is insubstantially different from the patent claim of swelling to retard flame. This would vitiate the claim requiring an "intumescent."

TieTex has proffered evidence that SV-X41 does not swell upon exposure to heat or flame. TieTex contends, and its evidence supports the proposition, that SV-X41 is chemically incapable of swelling but changes composition to become a "white powder" that "snuffs out" flames. (Doc. 133-12 at 10-11.) TieTex's evidence describes this reaction as indeed forming a "barrier," but through a "completely different" method than that employed by PFG's patents, without any swelling occurring. (Id. at 11.) This is sufficient to survive summary judgment on the doctrine of equivalents.

For similar reasons, PFG's second argument - that TieTex's fabrics use a "char-forming" compound that is "an intumescent

finish comprising one or more flame retardant phosphorus compounds or nitrogen compounds" - fails. (Doc. 114 at 18-19.) Here, too, PFG's argument relies on the meaning of the term "intumescent," and there is a genuine dispute as to whether SV-X41 swells when exposed to heat or flame. PFG also relies too heavily on statements by Royal Adhesives that its product forms an "intumescent char" and a "thermal insulation barrier." (Id. at 19.) Royal Adhesives is not a party to this action, and so while these statements are evidence, they are not admissions by TieTex as PFG would have them treated. Similarly, PFG leans on Horrocks' testimony a little too heavily. What Horrocks actually said in his deposition, in response to an inquiry by PFG, was that he agreed that he would expect the substrate of an uncoated fabric to contribute to the finish intumescing on exposure to heat or flame. (Doc. 114-11 at 198-99.) This speaks to the effect of the fabric, not to the effect of the coating, which is the claim in the patents in suit, and is consistent with his opinion that swelling observed by Bhat is attributable to the thickening of the fabric.

This court will therefore deny PFG's motion for summary judgment on its claim for infringement under the doctrine of equivalents. TieTex's evidence, if believed, supports the finding that TieTex's fabrics as coated with SV-X41 do not perform in a way substantially similar to the claims of the patents in question.

III. CONCLUSION

For the reasons stated above,

IT IS THEREFORE ORDERED that PFG's motion for partial summary judgment (Doc. 111 in case 1:13cv645, Doc. 81 in case 1:14cv650) is GRANTED IN PART AND DENIED IN PART as follows: PFG's motion as to Tietex's counterclaims of inequitable conduct and validity (Counts III, IV and V (both Counts V) is GRANTED, and those claims are DISMISSED; the motion is otherwise DENIED.

IT IS FURTHER ORDERED that PFG's motion to exclude expert testimony (Doc. 116 in case 1:13cv645, Doc. 86 in case 1:14cv650) is GRANTED IN PART AND DENIED IN PART, as noted herein.

 /s/ Thomas D. Schroeder
United States District Judge

November 21, 2016