

**UNITED STATES DISTRICT COURT  
DISTRICT OF NEW MEXICO**

**STC.UNM,**

**Plaintiff,**

**v.**

**INTEL CORPORATION**

**Defendant.**

**Civil No. 1:10-cv-01077-RB-WDS**

**STC.UNM'S REPLY BRIEF ON THE ISSUE OF CLAIM CONSTRUCTION**

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## **I. STC.UNM Requests Live Expert Testimony at the Claim Construction Hearing**

STC.UNM respectfully submits that the Court’s analysis would benefit from live expert testimony. The benefits would be two-fold: first, the experts, who are both teachers of lithography, could assist in explaining the complex technology to the Court; and second, the Court could observe the experts under cross examination to assess the credibility of the opinions. For example, while Intel’s expert, Dr. Smith, described his past professional experience in his first declaration (Doc. 111, ¶2), he failed to mention his having been the “Intel Professor” or other numerous affiliations with the Intel Corporation, including:

- ❑ “extremely valuable and important” monetary support for the naming rights of his professorship from 2000-2007 (Smith [Ex. 8], at 7:10-8:12, 13:6-9; 22:9-10; & Ex. 9);
- ❑ Intel’s hiring of half of his graduate students (Ex. 9);
- ❑ A 16-year, ongoing consulting relationship (Ex. 8, 17:7-16; Ex. 9; Doc. 135-1, at 9); and
- ❑ A recent visit to his website shows that the Rochester Institute of Technology still promotes Dr. Smith as the “Intel Professor.” Ex. 10 [RIT website (Sept. 29, 2011 )].

## **II. Argument**

The inventors provided three illustrated examples of how to combine patterns for the line trimming embodiment in Figures 6-8, followed by two columns of disclosure that elaborate on the exemplary line trimming embodiments. Ex. 1 [‘998 Patent], at 13:52-15:29. Intel’s constructions are so narrow, it is forced to take the position that claim 6 should not cover every exemplary embodiment that the inventors illustrated in the specification, *i.e.*, Figures 6, 7 or 8. *See Intel Resp. Br.* [Doc. 134], at 7; Smith [Ex. 8], 203:22-23. This fact, alone, should give the Court considerable pause when considering Intel’s arguments.

### ***A. “Spatial Frequencies”***

The parties have stipulated to an agreed construction for this term.

### ***B. “A Pattern Wherein the Fourier Transform of Said Pattern Contains High Spatial Frequencies”*** (STC.UNM, at 13, 5; Intel, at 17, 4)

STC.UNM: The final pattern resulting from the below method steps have spatial frequencies (1) that are not	Intel: a pattern whose density in the x-y plane (the plane of the substrate) is greater than the optical system
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present in any of the individual exposures, and (2) whose magnitudes are larger than the limit of the linear optical system response, resulting in sharper corners, smaller features, or higher pattern density.	could produce
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The parties' essential disagreement is whether "sharp corners" should be part of the claim construction. Dr. Smith "agree[d] that the inventor -- Professor Brueck is saying that the goal [of the patented invention] is sharp corners and he wants sharp corners." Smith [Ex. 8], at 44:21-23. And further "agree[d] that corners -- well-defined sharp corners are discussed" in Figures 2, 3, 6 and 7 of the patent, and that "there is no reference to increased pattern density in those excerpts." *Id.*, at 74:7-75:5. Dr. Smith further admitted that, in general, patterned features become more square as higher spatial frequencies are transmitted through the imaging tool. *Id.*, at 89:23-91:3; Ex. 15. These concessions not only explain why Intel's construction must be rejected, they support STC.UNM's construction for "sharper corners, smaller features, or higher pattern density," which are all characteristics of the claimed invention.<sup>1</sup>

Tellingly, Dr. Smith, instead of fully supporting Intel's construction, admitted that his declarations use *two different definitions* for the term high spatial frequencies: the first definition is "finer feature detail" (*i.e.*, sharp corners) (124:14-18), and the second definition is "pattern density" (129:5-13). He further admitted that *both definitions* apply to the claim language:

- Q. Which one applies to the claim language?
- A. They -- they both would.

*Id.*, 126:20-127:4. This creates a huge problem for Intel, as Intel's construction accounts for only one of the two definitions (pattern density) that Dr. Smith testified apply to the claim language.

Recall, the bulk of STC.UNM's construction is copied word-for-word from three important passages from the patent: Field of the Invention (1:66-2:7), Abstract (cover page); and Summary of the Invention (9:25-35). '998 Patent, [Ex. 1].

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<sup>1</sup> STC.UNM's inclusion of "smaller features" is synonymous with higher pattern density. As pattern density increases, the features naturally becomes smaller.

**C. “Combining Nonlinear Functions of Intensity of at Least Two Exposures Combined With at Least One Nonlinear Processing Step Intermediate Between the Two Exposures”** (STC.UNM, at 15, 11; Intel, at 21, 8)

STC.UNM: Combining the patterns that were formed in the two exposed photoresists, and having a non-linear process step, for example, development of the first resist, after the first exposure and before the second exposure.	Intel: Combining the response of two exposures of photoresist and at least one non-linear processing step (for example, development of the first photoresist) that occurs after the first exposure and before the second exposure
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The parties’ dispute for this term boils down to what is combined: “patterns” or “responses.” Intel’s construction – *on its face* – does not make sense. Intel argues that the limitation should be construed as the combination of exposed, but undeveloped, photoresists. Doc. 134, at 8-9. But the very claim language (“...with at least one non-linear processing step intermediate between the two exposures”) and both parties’ constructions, makes clear that the first exposed photoresist is developed into a pattern *prior* to the second exposure step. Thus, Intel’s construction of combining “exposure responses” makes no sense: it is impossible to combine two “exposures” because the first exposed resist is developed into a pattern *prior* to the second exposure step.

Intel argues in its response brief that STC.UNM’s construction is inconsistent with the prosecution history before the Patent Office (Doc. 134, at 9), but this is not true. STC.UNM’s prosecution history remarks are consistent with the construction where the output of the exposure function is patterned photoresist. Specifically, the remarks in the prosecution history are:

In other words, a linear process is one in which the Fourier transform of the *output* (e.g., *developed photoresist pattern* for a photolithography exposure/develop sequence) . . . .

Exh. 6 [Doc. 133-4], at 6 (emphasis added).

**D. “[First/Second] Pattern in Said [First/Second] Photoresist Layer”**  
(STC.UNM, at 17, 12; Intel, at 23, 12)

STC.UNM: Shape(s) resulting from developing the photoresist	Intel: the configuration of the [first/second] photoresist layer remaining after developing
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The parties' dispute is whether a pattern defined by mathematical spatial frequencies is a non-physical thing, “shapes,” or a physical thing, “configuration of the photoresist layer.” Intel

admits that “shapes” is an appropriate construction for “pattern” (Doc. 134, at 12), but its veiled effort for compromise does not make its construction accurate. Intel’s insistence that the claimed patterns be physical manifestations is wrong. As the remainder of the claim makes clear, the “pattern(s)” are “transferred” first to the “first mask” and ultimately to the “substrate.” There is no teaching in the patent, and it is next to impossible to imagine, how transferring the “configuration of the photoresist” could be accomplished.

**E. “First Mask Material”** (STC.UNM Brs. at 18, 13; Intel Br. at 22, 10)

STC.UNM: A layer of material used to preserve the first pattern for later use in the combined mask.	Intel: Material that is not photoresist, and that shields some or all of the underlying layer.
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In simplest terms, Intel’s construction defines how a mask material is used in single patterning processes, while STC.UNM’s defines how it is used in the patented double patterning process. Intel sidesteps this issue by arguing that STC.UNM is trying to avoid the distinction between mask and photoresist layers, but STC.UNM is not. If Intel finds this distinction necessary, STC.UNM is willing to make it part of its construction: “A layer of material that is not photoresist used to preserve the first pattern for later use in the combined mask.”

**F. “Parts of Said First Mask Layer”** (STC.UNM Br. at 20, 14; Intel Brs. at 23, 13)

STC.UNM: Some or all of the first pattern from the first mask layer.	Intel: the portions of the ‘first mask material’ that remain after the first ‘transferring’ step
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The crux is: Intel argues that “all” of the first and second patterns are transferred (Doc. 134, at 13-14), while STC.UNM’s construction allows for “some or all” of the pattern to be transferred. Intel’s expert initially tried to support Intel’s argument, but later capitulated and admitted that his own analysis is incompatible with Intel’s position, and supports STC.UNM’s construction:

- A. I stand corrected it [his analysis] doesn't show all of the first pattern and all of the second pattern transferred into the substrate.

Ex. 8, 198:25-199:5. This complete contradiction of Intel’s argument is additionally significant because these words are part of the larger “. . . combined mask . . .” limitation. Thus, even the building blocks of Intel’s construction for “combined mask” do not withstand scrutiny.

**G. “Combined Mask Including Parts of Said First Mask Layer and Said Second Photoresist”**  
(STC.UNM Brs. at 22, 18; Intel Br. at 26, 14)

STC.UNM: Layering of the two lithographic patterns in the two layers and/or in the hard mask layer.	Intel: A single mask consisting of (i) parts of said first mask layer (defined above) and (ii) the patterned second photoresist, with each of the two independently shielding some part of the substrate not shielded by the other.
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The patent teaches that the patterns can be transferred into the substrate in either of two ways: 1) using both the second resist and first mask, or 2) first transferring the pattern from the second resist into the first mask and then use that combined mask to transfer both patterns to the substrate. ‘998 Patent [Ex. 1], 9:57-59. Since Intel’s construction only applies to the first way, it should be rejected.

Moreover, Intel's construction should be rejected because it is only compatible with one of multiplication or addition, but not both, as STC.UNM’s expert explicitly states in his declaration. Mack Dec. [Ex. 7, Doc. 133-5], at ¶67. Even though Dr. Smith had exhaustively reviewed Dr. Mack’s declarations, he refused to acknowledge that he had considered this repudiation of Intel’s construction:

- A. Can we get addition in Figure 8? *I haven't looked at whether or not we can get addition in Figure 8.*
- Q. Okay. Let's just talk in general. Did anyone tell you or did you figure out yourself that if Intel's construction of combined mask were adopted, the result would be that you can either get multiplication or addition, but you can't get both?
- A. It sounds like something that I -- that I wasn't told and I don't believe that's a conclusion that I've drawn.

Smith [Ex. 8], at 199:24-200:6; 202:18-203:17 (objections omitted)(emphasis added).<sup>2</sup> The

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<sup>2</sup> In an attempt to opine that Figure 8 shows a multiplication of two patterns under Intel’s construction Dr. Smith was forced to reverse the math taught in the patent to obtain his conclusion. *See* Smith Dec. [Doc. 135], at ¶8. But Dr. Smith admitted that the ‘998 patent repeatedly assigns a thickness value of 1 to the presence of photoresist, and a

critical aspect of this testimony is what Dr. Smith *did not* say: He *did not* deny or even question that with Intel's construction one can only make patterns using multiplication or addition, but not both. Dr. Mack's statement stands unquestioned.

Importantly, this concession further solidifies Dr. Mack's conclusion that Intel's construction is not capable of making ***both holes and posts*** in the asserted line trimming embodiment. *See* Mack Dec. [Ex. 2, Doc. 113-5], ¶¶52-57. The '998 patent lists ten different lithographic applications for the invention, including the broad category of "electronics," to make "nm-scale features." Ex. 1 ['998 Patent], 9:36-45. A person skilled in the art would appreciate that the fabrication of both posts and holes is necessary for the applications listed by the inventors. Since claim 6 did not limit the combination of the patterns to multiplication or addition, and did not limit the pattern to be one of holes or posts, Intel's narrow construction must be rejected.

In its responsive brief, Intel contends that STC's construction would read "said second photoresist" out of the claim. *See* Doc. 134, at 14-15. Not true. The *overall claim term* of which the combined mask phrase is part refers to the transferring of patterns: "transferring said first pattern and said second pattern into said substrate using a combined mask including parts of said first mask layer and said second photoresist." The pattern created by the second photoresist, whether it be in the resist itself, or in the hardmask, is what is transferred. Contrary to Intel's assertion, "said second photoresist" is very much part of STC's construction.

Intel relies heavily on its contention that "the portion of the specification that corresponds to claim 6 appears at the bottom of column 13 and the top of column 14" (Doc. 134, at 15), suggesting that the other figures and embodiments of the specification are not covered by claim 6. This is just plain wrong. There is nothing in the specification or in claim 6 that states or

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thickness value of 0 to the absence of photoresist. Smith, at 189:21-190:1; 192-12-16. Thus, Dr. Smith assignment of 1's and 0's is the exact opposite of what is taught in the patent.



suggests that claim 6 is so limited. To the contrary, it is clear from reading the patent and claims that independent claims 1 and 6 cover all the embodiments in the specification (line trimming and inter-digitation) and independent claim 8 covers just inter-digitation. Intel tries (*Id.* at 17) to use its “claim 6 covers just col 13-14” argument to turn a blind eye to the explicit teaching of the patent that the final transferring step can be done in either of two ways: “layering of the two lithographic patterns in the two layers and/or in the hard mask layer.” But that teaching, which appears in the Summary of the Invention, cannot to be ignored, it is the inventor’s definitive statement of the final step of his invention.

In a further attempt to limit claim 6 to columns 13-14, Intel asserts that STC “assumes that the white portions of Figure 8C are posts . . . rather than holes.” *Id.* at 19. But as Dr. Mack declared this was not an assumption, the patent teaches that they are posts. Mack Dec. [Ex. 7, Doc. 133-5], at ¶46. Dr. Smith tried to rebut this in his declaration, not by referring to the intrinsic evidence, *i.e.*, the patent, but by baldly asserting 1) that there is a “convention” that white spaces represent holes; and 2) a “bar” can be a hole. On cross examination, Dr. Smith pulled back from both assertions: 1) “I’m not surprised that you could find references that show things contrary to the [white] convention or what I’ve said is typical.” (Ex. 8, at 154:24-155:4; Exs. 11-13); and 2) a “bar” is something made of material, *i.e.*, not a hole.<sup>3</sup>

In sum, the inventors chose claim language broad enough to include the combination of the two patterns in the two layers and/or in the hard mask layer. This is consistent with the explicit teachings of the patents and reflected in STC.UNM’s construction, which is copied *verbatim* from the specification. ‘998 Patent [Ex. 1], at 9:57-59.

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<sup>3</sup> Dr. Smith admitted that he has used the terms “scattering bar” and “anti-scattering bar” in his own patents. Smith [Ex. 8], at 171:1-2; Ex. 14. He further admitted that the term “scattering bar” refers to a feature where “there is material in the bar,” and an “anti-scattering bar is clear.” *Id.* at 172:6:15

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**CERTIFICATE OF SERVICE**

The undersigned certifies that on the 7th day of October, 2011 the foregoing was filed electronically through the CM/ECF system, which caused all parties or counsel to be served by electronic means.

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