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UNITED STATES DISTRICT COURT

DISTRICT OF NEW MEXICO

STC.UNM, Plaintiff, v. INTEL CORPORATION, Defendant.	Civil No. 1:10-cv-01077-RB-WDS

INTEL'S RESPONSE TO STC'S OPENING BRIEF ON CLAIM CONSTRUCTION

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Introduction

The parties' main claim construction dispute involves the "combined mask" limitation that appears in the second "transferring" step of claim 6:

> 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 claim language and the patent's specification leave no doubt that the "combined mask" must be a single mask including two parts: (1) a first mask layer containing the first pattern; and (2) a second photoresist layer containing the second pattern. Because Intel's accused manufacturing processes do not transfer two patterns using such a "combined mask," STC tries to read "and second photoresist" out of the claim. But the law of claim construction does not allow this. As STC itself recognizes (at 8), "[a] claim construction analysis must begin and remain centered on the claim language itself." *Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1116 (Fed. Cir. 2004). When a claim plainly states that a mask includes "said second photoresist," there is no avoiding "said second photoresist" in the construction.

STC protests that claim 6 must be read more broadly or else it will not cover every method described in the patent, but claim construction law does not require every claim to cover every embodiment. Here, claim 1 was written more broadly to cover a wider variety of ways of combining two patterns. Claim 6, by contrast, covers the method described at the bottom of column 13 and the top of column 14 of the patent. Intel's construction reflects that method and, contrary to STC's suggestion, is consistent with several of the patent's Figures as well.

Of the parties' six other claim construction disputes, four are directly or indirectly related to the requirement of "transferring" both patterns into the substrate using a "combined mask."

The other two involve the preamble's requirement that the claimed method achieve "high spatial frequencies." As to those, the parties essentially agree on what "spatial frequencies" are and even what "high" spatial frequencies" are. They disagree only about what "high spatial frequencies" in a Fourier transform *imply* about the corresponding real-world pattern. STC argues that "high spatial frequencies" correspond not only to greater feature density, but also to smaller features and squarer corners. But the specification does not correlate smaller features to "high spatial frequencies," and the prosecution history (which STC ignores throughout its opening brief) refutes STC's current argument that square-cornered features necessarily correspond to "high" spatial frequencies.

Reply Argument

A. "spatial frequencies" [of a Fourier transform]

Intel's Construction	STC's Construction
"a measure of how often components of an image or pattern repeat in a given unit of distance" Optional further explanation if the Court desires: "Technically speaking, a mathematical operation called the 'Fourier transform' represents the image or pattern as a series of waves, and 'spatial frequencies' indicate how frequently each of those waves repeats across space."	"A mathematical representation of a pattern. Technically defined, spatial frequencies are the coordinates in the Fourier plane resulting from the Fourier transform of the features that have been patterned."

STC's argument regarding "spatial frequencies" misconstrues Intel's construction and ignores basic problems with STC's own construction.

STC misreads Intel's proposed construction in charging (at 12) that it "only applies to repeating patterns." Intel's construction refers to repeating *components* of an image pattern; it does not require that the image or pattern itself repeat. As the second sentence of Intel's definition explains, those components are the waves modeled by the Fourier transform. The

patent itself defines "spatial frequencies" as the period of those component waves. ['998(2:25-26 ("'period' with dimensions of nm^{-1}, is used interchangeably with spatial frequency")], and basic texts on Fourier mathematics do as well [*see* Ferrall Decl. Exs. 6-8]. To be sure, Fourier transforms can also be represented by more complicated mathematical expressions such as integrals of complex exponential functions or, as STC would have it, "coordinates in the Fourier plane." But for present purposes, it is simpler, more intuitive, and accurate to describe Fourier transforms in terms of component waves. That is especially so given the applicants' repeated use of terms associated with waves, such as "frequencies," "periods," "amplitudes," and "phases."

STC also ignores the oversimplification in its own construction. Although STC proposes to construe "spatial frequencies" as a "mathematical representation of a pattern," the patent, its prosecution history, and the extrinsic evidence all confirm that the entire *Fourier transform* is the mathematical representation of the pattern and that spatial frequencies are only one aspect of a Fourier transform. As just discussed, a Fourier transform converts a pattern into a sum of component waves. Merely knowing the spatial *frequencies* of the pattern (how frequently each wave oscillates) is not enough to define the pattern; one also needs to know the *coefficients* of the spatial frequency terms (the amplitude or height of each wave) and *phases* (how far each wave is offset from the origin). The patent says so. [*See* '998(8:12-35) (explaining that the Fourier transform of a particular pattern, the fluence profile created by a two-beam interference, "consists of three components, a unity amplitude, zero frequency term and two components with amplitude ½ at [certain locations defined in part by the spatial frequency]"); '998(8:50-53) (referring to spatial frequency "components" of a pattern's Fourier transform)] The applicants said so in the prosecution history. [Ferrall Decl. Ex. 3 (5/18/99 Response and Amendment at 5)

("It is well known in the art that any pattern can be equivalently described by specifying the *amplitudes and phases* of the spatial frequencies in the pattern's Fourier transform.") (emphasis added)] And reference works on Fourier mathematics say so. [Ferrall Decl. Ex. 6 at 1, Ex. 7 at 1] STC's own citations to the specification are fully consistent. [*See* '998(12:63-13:15 & 16:10-26) (showing Fourier transform equations including more than just spatial frequencies)]

B. "a pattern wherein the Fourier transform of said pattern contains high spatial frequencies"

Intel's Construction	STC's Construction
"a pattern whose density in the *x*–*y* plane (the plane of the substrate) is greater than the optical system could produce"	"the final pattern resulting from the below method steps have spatial frequencies (1) that are not 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"

The parties agree that "high spatial frequencies" had no accepted meaning outside the context of the patent and thus should be construed in light of how the term was used in the intrinsic record (the specification and the prosecution history). Based on that intrinsic evidence, the parties also agree that "high" spatial frequencies must be spatial frequencies that do not appear in the Fourier transform of any of the individual images to which the workpiece is exposed and do have magnitudes larger than a linear optical system alone could produce. The parties even agree, in part, over what that definition implies for the corresponding patterns in the physical world. In particular, STC agrees with Intel that higher pattern density results in higher spatial frequencies (and "high" frequencies if they are beyond what the optical system could produce). Intel, however, disputes STC's contention that sharper corners and smaller feature sizes reflect the presence of additional, "high" spatial frequencies. In arguing otherwise, STC's brief misreads the specification and ignores what the applicants told the PTO.

STC's laundry list of citations from the patent (at 14) provides no support for its contention that "high spatial frequencies" correspond to smaller pattern features or squarer corners. The specification does state that "[t]he quality of an image is limited by the spatial frequencies within the image" ['998(2:10-11)], but it does not follow that "high spatial frequencies" mean smaller features or squarer corners. STC also cites statements in the background section of the patent that the semiconductor industry has worked to decrease λ (the wavelength of the laser light) and increase NA (the numerical aperture of the optical system) in order to improve image resolution and reduce feature size. [*See* '998(2:17-19, 28-30)] But this patent did not address ways of decreasing λ or increasing NA; it aimed to achieve "high spatial frequencies" by methods *other than* improving lasers, lenses, and other equipment. Finally, STC cites the patent's statement that "[t]he present invention is also preferably used to increase the number of transistors on semiconductor electronics, thereby allowing more and more smaller and smaller devices." ['998(20:10-13)] But that statement on its face referred to feature *density* (the number of features in a given area) and the size of the overall *device*, not to the size of particular *features*. STC also reads this passage (at 6) as saying that "[s]harp corners allow manufacturers to pack the transistors closer together, which translates to more powerful chips, and larger profit margins." But the passage did not mention sharp corners (or power or profit margins) at all.

To be sure, the specification described ways of producing rectangles with "sharp corners" when it discussed Figures 6A and 6B and 7A and 7B. [*See* '998(12:56-60) ("In contrast to the prior art methods which typically yield rounded co[rn]ers on the structures as shown in FIG. **6A**, the present invention suitably yields the patterns shown in FIG. **6B**, namely rectangles with sharp, well-defined co[rn]ers."); '998(13:14-31) (describing Figure 7B as an experimental

implementation of the Figure 6 pattern and concluding that the final pattern "shows substantially right angles at the co[rn]ers as predicted by Eq. 6 and FIG. **6B**")] STC incorrectly assumes, however, that Figures 6B and 7B showed a pattern with additional high spatial frequencies not present in Figures 6A and 7A. Although the specification itself was unclear, the prosecution history leaves no doubt that the applicants did *not* believe that squared-off features indicated the existence of additional, "high" spatial frequencies. Disputing the examiner's double patenting rejection, the applicants argued at length that the square and rounded patterns had the *same* spatial frequencies, just different *distributions* (*coefficients*) of those spatial frequencies:

> The presently claimed invention also changes magnitudes and phases of the Fourier *coefficients* between the process described by (expose, expose, nonlinear) and (expose, nonlinear, expose, nonlinear). Figures 6 and 7 exemplify this result by the demonstration of the round hole to square hole transition. *Both of the patterns have the same spatial frequencies*; however, the round (or elliptical) holes have a *distribution* of frequencies that radiates outward from the center of frequency space, while the square holes have frequencies only in the x and y directions perpendicular to the sides of the holes. The roll-off of the magnitudes of the Fourier coefficients is a more rapid function of the magnitude of the frequency in the round case than in the square case.

[Ferrall Decl. Ex. 2A (1/14/1999 Response and Amendment) at 9 (emphasis added)] Admissions in prosecution are routinely used to construe and limit the scope of claim language. *See Phillips v. AWH Corp.*, 415 F.3d 1313, 1317 (Fed. Cir. 2005) (en banc) ("[T]he prosecution history can often inform the meaning of the claim language by demonstrating how the inventor understood the invention and whether the inventor limited the invention in the course of prosecution, making the claim scope narrower than it would otherwise be."); *Altair Eng'g, Inc. v. LEDdynamics, Inc.*, 413 Fed. Appx. 251, 254-56 (Fed. Cir. 2011) (although "the figures in the specification in and of themselves [did] not define 'closely-spaced,' the prosecution history ma[de] clear that the district

court's [narrowing] construction [of that term was] correct"); *Solvay S.A. v. Honeywell Int'l, Inc.*, 622 F.3d 1367, 1385 (Fed. Cir. 2010) (although the specification was broad, prosecution history compelled a narrower reading requiring reactants to remain in the reactor in liquid form). STC cannot now retract its admission in the public record to achieve a broader construction here.

Ignoring the prosecution history, STC argues that Intel's construction would not cover Figure 6B and relies on the maxim that claim constructions excluding preferred embodiments are dispreferred. It is true that Intel's construction would not cover Figure 6B, but that does not make it wrong. The Federal Circuit has repeatedly recognized that not every claim needs to cover every disclosed embodiment. *See*, *e.g.*, *Sinorgchem Co., Shandong v. ITC*, 511 F.3d 1132, 1138 (Fed. Cir. 2007) (when "multiple embodiments are disclosed, we have previously interpreted claims to exclude embodiments where those embodiments are inconsistent with unambiguous language in the patent's specification or prosecution history"); *Helmsderfer v. Bobrick Washroom Equip., Inc.*, 527 F.3d 1379, 1383 (Fed. Cir. 2008) (affirming construction that excluded an embodiment because "[i]t is often the case that different claims are directed to and cover different disclosed embodiments"). Although courts generally strive to avoid a construction that reads out the *only* embodiment disclosed in a patent, courts ultimately must construe the claims as written and in light of the prosecution history as well as the specification. *See*, *e.g.*, *Lucent Techs., Inc. v. Gateway, Inc.*, 525 F.3d 1200, 1215-16 (Fed. Cir. 2008) (when the "claim language clearly supports [a] claim construction," the court may even "construe[] the claim[] to exclude all disclosed embodiments"); *N. Am. Container, Inc. v. Plastipak Packaging, Inc.*, 415 F.3d 1335, 1346 (Fed. Cir. 2005) ("[L]imitations may be construed to exclude a preferred embodiment if the prosecution history compels such a result."). Here, it is entirely

appropriate to exclude Figure 6B from the scope of claim 6 because the applicants themselves acknowledged that the Fourier transforms of the ultimate pattern there contained the same spatial frequencies that prior-art linear optical systems produced.

C. "combining nonlinear functions of intensity of at least two exposures combined with at least one nonlinear processing step intermediate between the two exposures"

Intel's Construction	STC's Construction
"combining the response of two exposures of photoresist and at least one nonlinear processing step (for example, development of the first photoresist) that occurs after the first exposure and before the second exposure"	"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"

STC's construction of the "combining" limitation is wrong for the reasons explained in Intel's opening brief. This term does not speak of combining two "patterns," much less combining patterns "formed in the two photoresists." It requires combining "nonlinear functions of intensity of at least two exposures" with an intermediate nonlinear processing step. The *eventual results* are three dimensional patterns, but that is reflected elsewhere, in the following phrase of the preamble ("to form three dimensional patterns") and in the body of the claim.

In justifying its construction, STC emphasizes (at 16) that the limitation uses the word "function." But Intel's proposed construction fully reflects that word: it refers to the *response* (the output) produced by the two exposures of photoresist (the inputs). Moreover, STC errs in suggesting that the "output" (result) of exposing photoresist is a pattern. In actuality, the output of an exposure is *exposed photoresist*; the physical *pattern* forms later, after the photoresist is *developed.* [Supplemental Declaration of Bruce Smith ("2d Smith Decl.") ¶ 3] As the body of claim 6 makes clear, exposing and developing are distinct steps in the process, and the phrase

"nonlinear functions of intensity of at least two *exposures*" focuses on the responses to the *exposures*, not the results of later development.

STC next argues (at 16) that the specification refers to the combination of the two output patterns as the combination of two input functions. In fact, however, the cited portions describe combining two *exposures* and nonlinear processing steps in a manner entirely consistent with Intel's construction. [*See* '998(12:23-24) ("two (or more) *exposures* are individually subjected to thresholding nonlinearities") (emphasis added); '998(12:61-62 (referring to "applying the thresholding nonlinearity individually to each *exposure*") (emphasis added)]

Furthermore, STC ignores the prosecution history. The convoluted phrase at issue was added during prosecution in order to distinguish the applicants' use of two exposures of photoresist layers with a developing step in between ("expose-develop-expose") from the prior-art approach of exposing twice and then developing ("expose-expose-develop"). [*See* Ferrall Decl. Ex. 3 (1/18/99 Response and Amendment) at 9-10] Intel's construction reflects both the claim language and its effort to capture the "expose-develop-expose" concept. STC's "pattern"-focused construction is consistent with neither the claim language nor the prosecution history. Moreover, STC fails to explain why the applicants did not use the more straightforward formulation "combining the patterns formed in two photoresist layers" if that is what they meant.

Finally, STC reveals its ulterior motive by quoting the Summary of the Invention and arguing that the patent covers combining two patterns in any two layers to produce a final pattern. In reality, STC is trying to set up its overbroad interpretation of "combined mask" in which it seeks to read out the "second photoresist" requirement. The limitation at issue here, however, is not about combining patterns; it addresses the supposedly novel "expose-develop-

expose" sequence. Precisely how the patterns must be combined is addressed *later* in the claim, in the second "transferring" step. And that limitation makes clear that claim 6, unlike claims 1 and 8, requires combining the two patterns in one particular way: "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*."[1]

D. "first mask material"

Intel's Construction	STC's Construction
"material that is not photoresist, and that shields some or all of the underlying layer"	"a layer of material used to preserve the first pattern for later use in the combined mask"

Claim 6 first refers to the "first mask material" in the first step of the body of the claim, which recites "coating a substrate with a first mask material and a first photoresist layer." Later, the claim requires the "first mask material" to be used in specific ways. In particular, the first "transferring" step requires "transferring said first pattern into said first mask material," and the second "transferring" step requires transferring that first pattern in the first mask material into the underlying substrate using a particular kind of "combined mask." But the definition of "first mask material" must reflect what the "first mask material" is in the first place.

Intel's construction makes clear what the "first mask material" is: a material that shields the underlying layer from an agent such as light or a chemical. The claim later specifies, in the first "transferring" step, that the "first mask material" must "compris[e] at least one of SiO_2,

[1] Notably, the preamble of claim 1 also contains this limitation, and the body of claim 1, like the body of claim 6, requires an "expose-develop-expose" sequence. Claim 1 is broader than claim 6, however, in that claim 1 does not require transferring both patterns using a combined mask. Claim 1's final step merely requires "combining said patterns to provide a final pattern." Intel discusses this point more fully below, in connection with the "combined mask" limitation.

Si_3N_4, a metal, a polysilicon and a polymer," but that requirement is plain on its face and STC does not dispute it. Intel's construction also makes clear what the "first mask material" is *not*: it must be distinct from both the first and second photoresist materials because the first "coating" step expressly requires coating the substrate with *both* a "first mask material" *and* "a first photoresist layer" and the second transferring step requires the "combined mask" to include *both* the "first mask layer" *and* the "second photoresist." *Cf. Phillips*, 415 F.3d at 1314 (the claim term "steel baffles" indicated that "baffles" were not inherently made of steel). Contrary to STC's suggestion, it is entirely appropriate to explain that the "first mask material" and the photoresist materials are distinct. Throughout its proposed constructions, STC is trying to blur the critical distinction between the mask and photoresist layers, and the Court must not permit STC to rewrite the claim into something different than what the PTO allowed.

STC's brief argues at length that the "first mask material" is used to preserve the first pattern for later use in the combined mask. But that is not a definition of what the "first mask material" *is* to begin with. To be sure, the "first mask material" *later* serves to preserve the first pattern. But that is so not because "mask material" inherently serves to preserve patterns; it is so because a *subsequent step* (the first "transferring" step) expressly requires "transferring said first pattern into said first mask material." The definition of "first mask material" needs to reflect the role and composition of the material at the outset, before it has been patterned, not just how the material is altered in a subsequent claim step whose scope the parties are not disputing.

E. “[first/second] pattern in said [first/second] photoresist layer”

Intel’s Construction	STC’s Construction
“the configuration of the [first/second] photoresist layer remaining after developing”	“shape(s) resulting from developing the photoresist”

The parties’ dispute over this term is more semantic than substantive. Nevertheless, STC’s construction is problematic because it refers to “shapes resulting from developing the photoresist” without saying where those “shapes” must be. The claim term itself makes clear that the pattern must be *in the photoresist layer itself*, not in some other layer. In particular, a “second pattern in said second photoresist layer” must be in the second photoresist.

STC quibbles (at 17) that Intel’s construction refers to “the physical embodiment of the shape in the photoresist,” rather than focusing on the “pattern or shapes that is [sic] being transferred to the final pattern.” But the claim term at issue here appears in the two “developing” steps, not in the “transferring” steps,” so it should explain what the step of developing produces. Developing is what produces the physical pattern in the photoresist. [2d Smith Decl. ¶ 3]

STC also prefers the word “shape” to “configuration,” arguing (at 17) that “the inventors described the patterns used by the claimed method as ‘shapes.’” Actually, “shapes” appears only once in the patent, and there it refers to two-dimensional elliptical and rectangular shapes of patterns ultimately produced in the plane of the substrate. [’998(9:19-23)] The patent does not refer to three-dimensional results of developing each layer of photoresist as “shapes.” In any event, if STC remains wedded to the word “shape,” Intel is willing to blend the parties’ proposed constructions and have this claim term construed as “the three-dimensional shape of the [first/second] photoresist layer that results from development of that photoresist layer.”

F. "parts of said first mask layer"

Intel's Construction	STC's Construction
"the portions of the 'first mask material' that remain after the first 'transferring' step"	"some or all of the first pattern from the first mask layer"

STC argues (at 20) that "parts of said first mask layer" should be construed in the context of the entire second "transferring" step, which reads:

> 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.

Intel agrees. STC also contends (at 20) that "the part of the first mask layer that is used in the 'combined mask' is itself the first pattern." Again, Intel agrees. Indeed, Intel's construction of "parts of said first mask layer" provides for just that: if the claimed process operates correctly, the portions of the "first mask material" that remain after the first "transferring" step will correspond to the "first pattern" originally created in the first photoresist layer.

The parties' real disagreement is whether this claim term requires the first component of the "combined mask" to include *all* of the first pattern (Intel's position) or just *some* of the first pattern (STC's position). The answer, according to STC's own analysis, is *all* of the first pattern. The entire step requires transferring "said first pattern," not "some or all" of the first pattern, and the specification never suggests that only a portion of the first pattern may be transferred. The claim does refer to "parts" of the "first mask layer," but that merely reflects that some of the "first mask material" is etched away during the first "transferring" step. The remaining portions of the "first mask layer" (the first pattern) are fully incorporated into the "combined mask." Similarly, the "parts" of "said second photoresist" that go into the "combined mask" are all

portions of the second photoresist layer that remain after that layer has been developed and thereby patterned. STC's brief does not even try to defend a construction requiring that only some and not all of the first pattern be transferred into the substrate.

G. "a combined mask including parts of said first mask layer and said second photoresist"

Intel's Construction	STC's Construction
"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"	"layering of the two lithographic patterns in the two layers and/or in the hard mask layer"

Intel's construction of the "combined mask" term is straightforward: the "combined mask" is a single mask whose first layer is the remaining portion of the "first mask layer" (containing the first pattern) and whose second layer is the remaining portion of the second photoresist layer (containing the second pattern). STC seems to agree that the "combined mask" must capture both patterns. STC also seems to agree that the first pattern must be preserved in the "first mask layer." But STC refuses to accept that the second pattern must be preserved in the *second photoresist* layer. Instead, by urging a construction that the "combined mask" can be any "layering of the two lithographic patterns in the two [photoresist] layers *and/or in the hard mask layer*," STC is contending that claim 6 covers methods in which both patterns are preserved in the hard mask layer and neither pattern is preserved in the second photoresist layer.

Such a broad construction contradicts the claim language expressly requiring the "combined mask" to include "*said second photoresist*" as well as "said first mask layer." Under settled law, "*and said second photoresist*" must not be read out of the claim. *See*, *e.g.*, *Bicon, Inc. v. Straumann Co.*, 441 F.3d 945, 950 (Fed. Cir. 2006) ("[C]laims are interpreted with an eye

toward giving effect to all terms in the claim."; rejecting construction that rendered limitations superfluous and meaningless); *Becton, Dickinson & Co. v. Tyco Healthcare Group, LP*, 616 F.3d 1249, 1257 (Fed. Cir. 2010) (rejecting construction that would have rendered a limitation functionally meaningless). As STC itself urges elsewhere in its brief (at 8), "[a] claim construction analysis must begin and remain centered on the claim language itself" (quoting *Innova/Pure Water*, 381 F.3d at 1116). STC's construction of the "combined mask" term fails to do so and should therefore be rejected. *See also Phillips*, 415 F.3d at 1312 ("[T]he claims are 'of primary importance, in the effort to ascertain precisely what it is that is patented.' … Because the patentee is required to 'define precisely what his invention is,' … it is 'unjust to the public, as well as an evasion of the law, to construe it in a manner different from the plain import of its terms.'") (quoting *Merrill v. Yeomans*, 94 U.S. 568, 570 (1876), and *White v. Dunbar*, 119 U.S. 47, 52 (1886)).

Of course, claims are construed in light of the specification and the prosecution history, but nothing in either one requires or permits the Court to ignore the plain language of claim 6. To the contrary, the specification and prosecution history fully support Intel's reading:

Columns 13 and 14. The portion of the specification that corresponds to claim 6 appears at the bottom of column 13 and the top of column 14 of the specification. That passage first describes using an exposure/development sequence to create a first pattern in a first photoresist layer, and then transferring (etching) that first pattern into a sacrificial layer:

> In a preferred embodiment, a sacrificial layer, such as, for example, a SiO_2 or Si_3N_4 layer, is used with additional processing between the two exposures. More particularly, following a suitable interferometric lithography exposure and develop of a first pattern in a first photoresist lawyer, the resulting pattern is transferred into the sacrificial layer by a suitable etching step.

['998(13:62-14:2)] Next, the remnants of the first photoresist layer are removed, the wafer is coated with a second photoresist layer, and the second pattern is then created in that layer using a second exposure and development sequence:

> Any remaining photoresist from the first photoresist layer is then removed and the wafer is then preferably coated with a second photoresist layer and a second exposure and develop sequence is suitably carried out to transfer a second pattern into this second photoresist layer.

['998(14:2-7)] Then, a "second etch step" is carried out "to transfer the combined pattern into the underlying wafer layers" using a "combined etch mask" whose parts include *both* the sacrificial layer *and* the portions of the second photoresist that were not developed and washed away:

> A second etch step is preferably carried out to transfer the combined pattern into the underlying wafer layers. The second etch step preferably uses a *combined etch mask*, parts of which are preferably comprised of the nitride layer and *parts of which are comprised of the undeveloped photoresist layer*.

['998(14:8-13) (emphasis added)] Finally, both layers of the "combined mask" (the sacrificial layer *and* the separate, distinct second photoresist) are removed to reveal the combined pattern:

> Finally, the remaining mask layers, *both photoresist and sacrificial material*, are preferably removed.

['998(14:15-17)]

This passage tracks claim 6, and it confirms that the "combined mask" includes the second photoresist layer as well as the sacrificial mask layer. Moreover, it contradicts STC's effort to read out "and said second photoresist" and allow the "combined mask" to consist solely of the sacrificial mask layer. Not surprisingly, STC's opening brief ignores it entirely.

The Summary of the Invention. In arguing for a broader construction untethered to the wording of claim 6, STC primarily argues that its construction ("layering of the two lithographic

patterns in the two layers and/or in the hard mask layer") appears verbatim in the Summary of the Invention in column 9. [*See* '998(9:57-59)] But the Summary was a generic description of the applicants' overall approach, not a description of the embodiment described in columns 13 and 14 and claimed in claim 6. A "layering of the two lithographic patterns" in the two *photoresist* layers—"in the two layers" plainly referred to the two photoresist layers described just previously in the specification, *see* '998(9:46-56)—is inconsistent with claim 6 because claim 6 requires the "combined mask" to include parts of the "first mask layer." Likewise, a "layering of the two lithographic patterns" "in the hard mask layer" alone is inconsistent with claim 6 because claim 6 requires the "combined mask" to include parts of "said second photoresist."

The broad summary in column 9 (and STC's construction) may correspond to *claim 1*, broadly interpreted. Claim 1, which STC has not asserted in this case due to invalidity concerns, recites forming one pattern in a first photoresist layer and then forming a second pattern in a second photoresist layer. Although claim 1 does not recite an additional step of transferring either one or both of those patterns into a separate mask layer, the claimed method is open-ended and does not expressly foreclose such a step. Furthermore, claim 1's final step merely requires "combining said patterns to provide a final pattern" without specifying how. But even if "layering of the two lithographic patterns in the two [photoresist] layers and/or in the hard mask layer" corresponds to the final step of *claim 1*, STC's construction cannot be squared with the express terms of the critical "combined mask" limitation of the claim at issue now, *claim 6*.

Figure 7B. STC also relies on the specification's discussion of Figure 7B in column 13. But that discussion expressly describes a first pattern (vertical lines) in the sacrificial nitride layer, a second pattern (horizontal lines) in the second photoresist layer, and a "composite mask

pattern" produced by the two. ['998(13:23-31)] That discussion is fully consistent with Intel's construction of the "combined mask" limitation. STC argues otherwise only by contending (at 24) that Figure 7B may show "posts" rather than "holes." But STC is reimagining the patent to suit its needs. The "combined mask" shown in Figure 7B plainly outlines *holes* formed by the mask and the second photoresist:

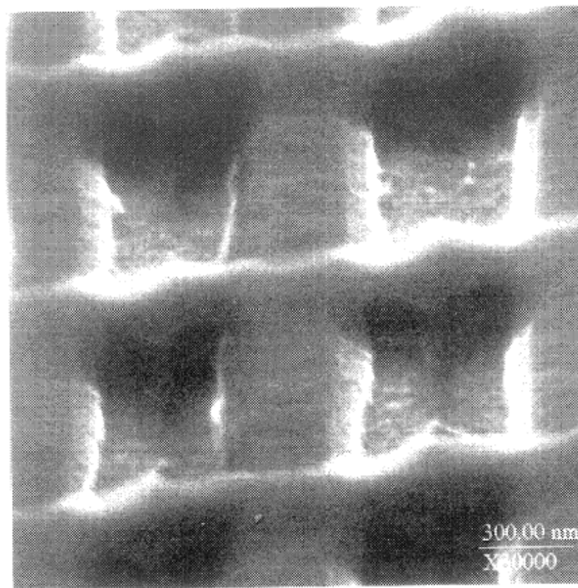

FIG. 7B

<u>Figure 8</u>. STC next relies on a summary description of Figure 8 in column 11. According to STC, this passage shows transferring the pattern from the second photoresist to the hardmask to create a double pattern in the hardmask. In truth, the passage says *nothing* about transferring the second pattern from the second photoresist to the hardmask and removing the photoresist:

> FIGS. **8A-8C** show the application of the present invention to the prototypical pattern of FIG. 1 wherein FIG. **8A** shows the result of a simple two-beam interferometric exposure, FIG. **8B** shows the result of an incoherently illuminated imaging optical exposure (NA=0.6@365 nm) and FIG. **8C** shows the result of multiplying the two images using a combined mask.

['998(11:22-28)] For all we know, the Figure 8A pattern may have been etched into a hard mask and the Figure 8B pattern may have remained in the second photoresist layer, consistent with columns 13-14—and in that case Figure 8C *was* the result of a "combined mask" under claim 6.

In charging that Figure 8 is incompatible with Intel's construction, STC *assumes* (at 23-24) that the white portions of Figure 8C are "posts" rising above the speckled portions, rather than "holes" beneath. But that assumption is wrong. The usual convention is for white to indicate "holes" [2d Smith Decl. ¶ 6], and the applicants indicated in the prosecution history that they were employing that convention in this patent [*see* Ferrall Decl. Ex. 3 (1/14/1999 Response and Amendment) at 9 (referring to the white portions of Figure 6 as "holes")]. Properly viewed in that light, Figure 8 is fully consistent with Intel's construction. [2d Smith Decl. ¶ 8; *see also id.* ¶ 6 (noting that the specification's reference to "bars" in Figure 1 may also refer to "holes")]

Figure 9. STC next points to the discussion of Figure 9 of the patent in columns 15 and 16. This portion of the specification does indeed describe transferring both patterns into an underlying hard mask material, consistent with claim 8 (and various other claims). But Claim 6 expressly requires the "combined mask" to include *both* a pattern in the mask layer *and* a pattern in the second photoresist. As much as STC desires to stretch claim 6, it cannot unilaterally excise the words "*and said second photoresist*" from the claim's text.[2]

"**Multiplication.**" STC also contends that Intel's construction would not cover combining two patterns by "multiplication." That accusation is demonstrably false. As shown above, Intel's construction tracks the discussion in columns 13 and 14. And that discussion

[2] To be clear, Intel is not suggesting that the "pitch-halving" approach described in the patent is incompatible with use of the "combined mask" required by claim 6. With a slight modification, Figure 9 could have shown both "pitch-halving" and the "combined mask" of claim 6. Indeed, Figure 5 of Intel's opening brief is similar to Figure 9 and does show both.

expressly describes the "combined etch mask" consisting of the mask layer and the second photoresist layer as providing a "multiplication operation." ['998(14:15)] Intel is not reading "multiplication" approaches out of claim 6. But Intel does contend that any process lacking a "combined mask," regardless of the mathematical function it represents, falls outside claim 6.

STC's Legal Argument. STC ultimately resorts to a bare legal argument that claim 6 must be construed broadly so that it covers every embodiment described in the patent. But that is not the law: no case holds that all claims must cover all embodiments, and the Federal Circuit routinely adopts constructions that track particular embodiments because it is normal for patent prosecutors to tailor claims to particular embodiments. *See*, *e.g.*, *Baran v. Med. Device Techs., Inc.*, 616 F.3d 1309, 1316 (Fed. Cir. 2010) ("It is not necessary that each claim read on every embodiment," and "[i]t is often the case that different claims are directed to and cover different disclosed embodiments."); *Helmsderfer*, 527 F.3d at 1383. Here, for example, claim 8 specifically requires interleaving the features from two exposures of the same "periodic pattern" and thus covers some embodiments (e.g., the Figure 9 embodiment discussed in paragraphs 15 and 16), but not others (e.g., Figures 6, 7 and 8). Similarly, claim 6 requires a particular kind of "combined mask" comprised of a first pattern embodied in the first mask layer and a second pattern embodied in the second photoresist layer. It too covers some of the disclosed embodiments and not others, and there is nothing wrong with construing it that way.

Conclusion

Intel's proposed constructions are well grounded and should be adopted. STC's proposed constructions are not well ground and should be rejected.

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Respectfully submitted,

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Certificate of Service

The undersigned hereby certifies that on July 25, 2011, the foregoing document and the cited declarations were electronically filed with the Clerk of Court using the CM/ECF system, which will automatically send notification of such filing to all counsel who have entered an appearance in this action.

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