

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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TAIWAN SEMICONDUCTOR MANUFACTURING COMPANY, LTD. and  
GLOBALFOUNDRIES U.S. INC.,  
Petitioners,

v.

GODO KAISHA IP BRIDGE 1,  
Patent Owner.

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Case No. IPR2016-01376<sup>1</sup>  
Patent Number 6,197,696

Before JUSTIN T. ARBES, MICHAEL J. FITZPATRICK, and  
JENNIFER MEYER CHAGNON, *Administrative Patent Judges*.

**PATENT OWNER'S MOTION FOR  
OBSERVATIONS ON CROSS EXAMINATION**

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<sup>1</sup> GlobalFoundries U.S. Inc., who filed Petition IPR2017-00921, has been joined as a petitioner in this proceeding.

Patent Owner Godo Kaisha IP Bridge 1 (“Patent Owner”) respectfully moves for observation of the following testimony from the August 2, 2017 cross-examination by deposition of Dr. Bruce Smith, expert witness for Petitioner Taiwan Semiconductor Manufacturing Company, Ltd. (“Petitioner” or “TSMC”), submitted herewith as EX2040.

1. In EX2040, at 12:14-15:22, Dr. Smith testified about his “interpretation” of the sentence “In this case the second resist pattern 359 is removed during the step of etching the organic film 354,” in ¶93 of EX1014 (Petitioner’s Certified Translation of the ’696 Foreign Priority Document). Dr. Smith testified that he interprets this sentence to mean “the second resist pattern [359] is *at least partially* removed during this step of etching the organic film 354.” EX2040, 15:16-22.<sup>2</sup> This testimony is relevant to Petitioner’s assertions and Dr. Smith’s allegations at EX1049 ¶¶34-36, that Patent Owner “mistakenly suggest that the Japanese ’371 application supports step i) of claim 13” because Dr. Smith asserts that “there is no reason to think second resist pattern 359 is removed before the complete patterning of layer 354.” EX1049 ¶35; *see also* Paper 26 (“Reply”) 13. This testimony is relevant because Petitioner’s and Dr. Smith’s analysis attempts improperly to

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<sup>2</sup> Emphasis added throughout unless otherwise indicated.

rewrite the Japanese Application's express disclosures to avoid the '696 claims being entitled to their earlier priority date.

2. In EX2040, at 16:1-17:20, Dr. Smith testified about Figures 16(b) to 16(c) and 19:41-45 of the '696 patent (EX1001). Dr. Smith was asked, "Is film 354A being used as a mask in etching film 353?" and answered that "***It says that in the specification, but 354A is not – would not be part of the mask that would be etching 353.***" EX2040, 18:3-7. This testimony is relevant because it is inconsistent with and contradicts, in addition to the '696 patent specification itself, (1) Petitioner's argument that layer 354A is "exposed to act as a mask" (Reply 14), and (2) the Board's construction of "using [the designated layer] as a mask," which "does not preclude, for example, a layer positioned between an overlying layer and the layer being etched from acting as a mask ... in an instance where the overlying layer also is removed during the etching, and thus, the between layer acts to shield the layer being etched during etching" (Paper 11 at 18 n.7). This testimony is also relevant to Petitioner's assertion (Reply 8-9) and Dr. Smith's opinions in EX1049 ¶¶20-28 regarding alleged "inconsistencies in the '696 patent." This testimony is relevant because it illustrates that Dr. Smith's analysis of Figures 16(c) and 16(d) of the '696 patent ignores and contradicts the express language in the specification, which states, "[n]ext, as shown in FIG. 16(c), the first silicon dioxide film 353 is dry-etched ***using*** the patterned second silicon dioxide film 355A and ***the patterned***

*organic film 354A as a mask ....*” EX1001, 19:41-45. This testimony is also relevant because it is apparent that Dr. Smith did not recognize the inconsistencies in his testimony until Petitioner directed his attention to them through a series of leading questions, and Dr. Smith never addressed or explained those inconsistencies with his earlier testimony or clarified which interpretation he applied. EX2040, 59:16-60:3.

3. In EX2040, at 18:13-20:20, Dr. Smith testified about processing layers 504A, 505A and 503 in Figures 23(b) and 23(c) and 24:7-10 of the '696 patent (EX1001). Dr. Smith testified that “[t]he organic -- first organic film 503 is therefore etched using the patterned first silicon dioxide film 504A as a mask.” EX2040, 19:6-8. Dr. Smith additionally testified that layer “505A *does act as – as the mask for 503*” as shown in Figures 23(b) and 23(c), even though Dr. Smith understands the '696 specification to only say “first organic film 503 is therefore etched using the patterned first silicon dioxide film 504A as a mask.” EX2040, 20:19-20, 19:2-13 (citing EX1001, 24:7-10). This testimony is relevant to Petitioner’s assertions (Reply 8-9) and Dr. Smith’s opinions in EX1049 ¶¶20-28 and Petitioner’s arguments regarding purported “inconsistencies in the '696 patent” concerning whether a buried layer that has a lateral edge “in line and flush with [a lateral] edge of” an overlying layer can act as a mask, because it is inconsistent with those opinions and arguments. Specifically, Dr. Smith previously asserted that the '696

patent is internally inconsistent because, he argued “three examples IPB identified where a buried layer is called a ‘mask’ in the specification” contradict “at least seven examples in the specification where a buried layer is ***not called a ‘mask.’***” EX1049, ¶27. But in the cross-examination testimony, Dr. Smith testified that a layer “***505A does act as – as the mask for 503,***” even though the ’696 specification does not call layer 505A a mask. EX2040, 20:19-20, 19:2-13 (citing EX1001, 24:7-10). This testimony is also relevant to Petitioner’s assertions and Dr. Smith’s opinions in EX1049 ¶¶30-33 regarding whether “the Japanese ’371 application supports step h) of claim 13.” EX1049, ¶30; *see also* Reply 10-11 (“The ***specification identifies layer 359, not layer 358, as the mask*** for etching layer 355 above.”). This cross-examination testimony is relevant because it illustrates inconsistencies in Petitioner’s and Dr. Smith’s interpretation of the ’696 patent and the Japanese ’371 application. Dr. Smith previously testified that layer 358 is not used as a mask to etch layer 355 because the “Japanese ’371 application ***makes no mention*** of using layer 358 as a ‘mask’” (EX1049, ¶31; Reply 11), but on cross-examination inconsistently testified that “505A does act as – as the mask for 503” as shown in Figures 23(b) and 23(c), even though this is not described in the detailed description of the ’696 patent (*see, e.g.*, Ex. 1001, 24:7-10). EX2040, 20:19-20.

4. In EX2040, at 20:21-22:1, Dr. Smith testified about processing layers 603, 604A, and 605A in Figures 32(a) and 32(b) of the '696 patent (EX1001). Dr. Smith testified that "the patent describes 604A as a mask for the etching of the hole 611 into film 603." EX2040, 21:16-17. Dr. Smith additionally testified that "605A will act to mask etching until the film is removed, until that film is completely removed," as shown in Figures 32(a) and 32(b). EX2040, 21:20-22:1. This testimony is relevant to the same opinions in EX1049 ¶¶30-33 regarding whether "the Japanese '371 application supports step h) of claim 13," as identified in paragraph 3, above. This cross-examination testimony is relevant because it illustrates inconsistencies in Petitioner's and Dr. Smith's interpretation of the '696 patent and the Japanese '371 application. Dr. Smith previously opined that layer 358 is not used as a mask to etch layer 355 because the "Japanese '371 application *makes no mention* of using layer 358 as a 'mask'" (EX1049, ¶31; Reply 11), but now on cross-examination has inconsistently testified that layer "605A will act to mask etching until the film [603] is removed" as shown in Figures 32(a) and 32(b), even though this is not expressly described in the detailed description of the '696 patent (*see, e.g.*, Ex. 1001, 29:6-12). EX2040, 21:20-22:1.

5. In EX2040, at 27:13-33:12, Dr. Smith testified that a dry etching process, such as reactive ion etching, could have a lateral etching component. Dr. Smith testified that "an RIE [reactive ion etching] process could allow for a – could allow

for chemical species to result in an anisotropy”—that is “a lateral effect, a lateral removal, which could be from the flow of – or the motion of chemical species.” EX2040, 32:16-33:1. This testimony is relevant to Petitioner’s assertion (Reply 5-6) and Dr. Smith’s opinion at EX1049 ¶¶8-19, regarding the construction of the term “using the [designated layer] as a mask.” The testimony on cross is relevant because, while Dr. Smith previously testified that the vertical sidewalls do not play a role in dry etching, such as RIE, he now admits that there are lateral effects even in these dry etches. Specifically, Dr. Smith previously opined that “vertical sidewalls in the opening that defines the pattern being etched do not ‘mask’ the etch and are not relevant to the masking function.” EX1049 ¶11. Dr. Smith also opined that “the interior surfaces of the layers above the layer being etched do not apply the masking role IPB and Dr. Glew suggest.” EX1049 ¶15. Dr. Smith has also previously used the term “anisotropic” to describe “highly directional,” and the term “anisotropic etching” to refer to “directional” etching. EX1049 ¶¶13-14 (citing to *Plummer* (EX1030, 626-27)). Dr. Smith also testified that “[a]nisotropic etch conventionally is – conventionally is considered to be one direction.” EX2040, 33:13-18. In contrast, Dr. Smith’s testimony on cross that an RIE process could result in “anisotropy” where “lateral removal” could occur (*e.g.*, via lateral flow of etchant) (EX2040, 32:16-33:1), is inconsistent with his aforementioned

opinions that vertical sidewalls do not “mask” an etch, at least because vertical sidewalls block lateral removal and lateral flow of etchant.

6. In EX2040, at 33:13-38:9, Dr. Smith answered affirmatively when asked whether reactive ion etching includes “neutral and ionic components,” which “contribute to lateral removal.” When asked to confirm that “both neutral and ionic species [are] present in reactive ion etching,” Dr. Smith answered “That’s right.” EX2040, 36:22-37:3. Dr. Smith testified that “the combination of the chemically reactive and chemically neutral species, it’s the combination of the chemical etch and the physical etch, that result in things like anisotropy of an RIE process.” EX2040, 37:22-38:4. When asked whether “both the neutral and ionic components contribute to lateral removal,” Dr. Smith replied in the affirmative, “Yes, they work together.” EX2040, 38:5-9. This testimony is relevant to the same opinions in EX1049 ¶¶8-19, identified in paragraph 6, above, that “the interior surfaces of the layers above the layer being etched do not apply the masking role IPB and Dr. Glew suggest” (EX1049 ¶15), and “anisotropic etching” refers to “directional” etching (EX1049 ¶¶13-14 (citing to *Plummer* (EX1030, 626-27))). *See also* Reply 5-6. Dr. Smith’s testimony on cross is relevant because it confirms that “the combination of the chemically reactive and chemically neutral species” result in “anisotropy of an RIE process” (EX2040, 37:22-38:4) and that “both the neutral and ionic components contribute to ***lateral removal***” (EX2040, 38:5-9). Dr.



Smith's testimony on cross is relevant because it is inconsistent with his aforementioned opinions, and Petitioner's assertions, that vertical sidewalls do not "mask" an etch (EX1049 ¶15; Reply 5-6), at least because he now concedes that the vertical sidewalls block lateral removal and lateral flow of etchant.

7. In EX2040, at 40:13-50:5, Dr. Smith testified regarding the terms "transferring ... while concurrently removing" and "transferring, at least partially concurrently removing" in claim 28 of Grill (EX1005). When asked "[w]hat is the difference between concurrently and partially concurrently," Dr. Smith testified that "simply said, *concurrently, it wouldn't cover the situation where one layer is removed before another layer is completely removed.*" EX2040, 44:14-21. This testimony is relevant to Dr. Smith's opinions at EX1049 ¶¶43-46, and Petitioner's related assertions regarding whether Claim 28 of Grill's non-provisional application is supported by Grill's provisional application, and whether Grill can claim a priority date earlier than its non-provisional filing date. *See also* Reply 14-21. This testimony is relevant because it contradicts and is inconsistent with Dr. Smith's earlier opinion that "as I [Dr. Smith] understand it, claim 28 recites the phrase 'while concurrently removing,' which indicates the removal process need not be completed for the claim element to be satisfied"—*i.e.*, that "while concurrently removing" covers a case where the photoresist layer is not completely removed as an underlying film is etched. EX1049 ¶46 n.1. This testimony is also

relevant because it contradicts and is inconsistent with Petitioner's assertion that "claim 28 reads 'while concurrently removing,' indicating the removal process need not be completed." Reply 21 n.6.

8. In EX2040, at 47:13-50:5, Dr. Smith testified that the term "transferring said via pattern ... into said second dielectric layer, **while concurrently removing** said via-patterned second layer of resist" of Grill's claim 28 (EX1005, 13:47-50) covers a case where some of the second layer of resist is removed **after** the second dielectric layer is etched. Dr. Smith testified that in meeting this limitation of Grill's claim 28, "the photoresist cannot be removed **before** the dielectric layer is patterned," and that some "photoresist is removed" "after the second dielectric layer is removed in that via pattern." EX2040, 47:13-20, 48:8-49:2. This testimony is relevant to Dr. Smith's previous opinions at EX1049 ¶¶43-46, and Petitioner's related assertions regarding whether Claim 28 of Grill's non-provisional application is supported by Grill's provisional application, and whether Grill can claim a priority date earlier than its non-provisional filing date. *See also* Reply 14-21. This testimony is relevant because it demonstrates Petitioner's and Dr. Smith's analysis of claim 28 and whether it is supported by the earlier provisional application depends upon an improper attempt to rewrite claim 28's express language, which requires "transferring said via pattern ... into said second dielectric layer, while **concurrently removing** said via-patterned second layer of

resist,” to include non-concurrent removal of a portion of the second layer of resist *after* the second dielectric layer has been etched. This testimony is also relevant because it is inconsistent with Dr. Smith’s testimony that “simply said, concurrently, it wouldn’t cover the situation where *one layer is removed before another layer is completely removed.*” EX2040, 44:14-21.

9. In EX2040, at 40:13-50:5, Dr. Smith testified that the difference between “transferring concurrently” at 13:47-50, and “transferring at least partially concurrently” at 13:53-57 in Claim 28 of Grill (EX1005) is that 13:53-57 refers to a “concurrent etch,” whereas 13:47-50 does not because the term “removing said via-patterned second layer of resist” at 13:47-50 does not refer to the etching of a film. *See* EX2040, 41:21-42:21. Dr. Smith testified that “it’s not etching of two films in that first instance.” EX2040, at 44:12-13. (Dr. Smith used the phrase “first instance” to refer to “line 47-ish to line 50,” which recites the term “transferring said via pattern ... into said second dielectric layer, while concurrently removing said via-patterned second layer of resist.” EX2040, at 42:15-17; EX1005, 13:47-50.) This testimony is relevant to Dr. Smith’s prior opinions at EX1049 ¶¶43-46, and Petitioner’s related assertions regarding whether Claim 28 of Grill’s non-provisional application is supported by Grill’s provisional application, and whether Grill can claim a priority date earlier than its non-provisional filing date. *See also* Reply 14-21. This testimony is relevant because it is inconsistent with Dr. Smith’s

previous opinions in EX1049, at ¶36, that an “overetch” technique is used to remove resist pattern 359. This testimony is also relevant because it is inconsistent with Petitioner’s assertion that the “overetch” technique is used to remove resist pattern 359. *See* Reply 13.

10. In EX2040, at 50:6-51:15, Dr. Smith testified about his interpretation of the term “features” and “substantially” in the following passage of Grill: “dual relief patterns in which all *features* of a smaller area (via) pattern *substantially* overlap with the features of a larger area (wiring) pattern.” EX1005, 7:25-30. When asked whether “the *features* that are being referred to are openings,” Dr. Smith responded affirmatively “[i]t is the openings ... the openings in these two layers.” EX2040, 51:4-9. Dr. Smith then confirmed that “the *features* I’m referring to in that last sentence is the dual relief pattern, which collectively refers to those openings, yes.” EX2040, 51:10-15. When asked whether the term “substantially” in Grill’s phrase “a smaller area (via) pattern substantially overlap with the features of a larger area (wiring) pattern” (EX1005, 7:25-30) would “encompass also the term ‘completely,’” Dr. Smith answered in the affirmative, “[s]ure, yeah. That’s right.” EX2040, 51:20-52:1. This testimony is relevant to Petitioner’s assertion (Reply 23-24) and Dr. Smith’s opinion in EX1049 ¶¶55-57 concerning “whether using Aoyama’s via pattern ... eliminates the ‘dual-relief pattern’ Grill teaches” and that “[t]he dual relief pattern collectively refers to the openings in the blue

layer (a wiring pattern) and the green layer (a via pattern),” where the wiring pattern and via pattern are distinct. This testimony is relevant because Petitioner and Dr. Smith rely on this sentence from Grill to argue that the dual relief pattern in Grill would not be eliminated by applying Aoyama’s teachings, but their interpretation of Grill’s sentence is nonsensical as it would result in the following understanding that allows for the elimination not only of the dual relief pattern, but also of the distinction between the wiring pattern and the via entirely: “dual relief patterns in which all *openingsfeatures* of a smaller area (via) pattern *completelysubstantially* overlap with the *openingsfeatures* of a larger area (wiring) pattern.” Cf. EX1005, 7:25-30. That is, this testimony is relevant to show that Dr. Smith’s understanding of the term “substantially overlap” includes situations where the feature (*i.e.*, opening) of underlying via pattern shares the exact same feature (*i.e.*, opening) of an overlying wire pattern, thereby eliminating the distinction between the via pattern and the wire pattern. This testimony is also relevant because it is inconsistent with the plain language of Grill, which describes a “smaller area (via) pattern” and a “larger area (wiring) pattern.” EX1005, 7:22-30.

11. In EX2040, at 52:2-53:6, Dr. Smith testified that “cross-sections going into the page” in Grill might look different than what was shown in Grill’s figures. When asked whether “other cross-sections going into the page might look different

than what's shown in these figures [5A-5H of Grill]," Dr. Smith responded affirmatively "[s]ure." EX2040, 53:2-6. This testimony is relevant to what one of ordinary skill would have understood based on Grill's figures and the '696 patent's figures. This testimony is also relevant to Dr. Smith's previous opinions in EX1049 ¶¶20-28 regarding the construction of the term, "using the [designated layer] as a mask." Dr. Smith opined in EX1049 at ¶24 that "the statement in IPB's Preliminary Response that 'there are other cross-sections in which the second resist pattern and the mask pattern, shown in one cross-section in Figures 22(b) and 22(c), either have edges lined up and flush with one another' is untrue. EX1049 ¶24 (citing Paper 6 at 42). Dr. Smith's cross-examination testimony is relevant because, in confirming that other cross-sections of Grill's figures 5A-5H going into the page "might look different than what's shown," it contradicts his earlier opinion that no such cross-sections proposed by Patent Owner in the preliminary response could exist. Paper 6 at 42.

12. In EX2040, at 53:7-16, Dr. Smith testified that 8:24-31 of Grill (EX1005) describes Grill's Figure 6A. When asked whether "this portion of Grill [column 8, lines 24 to 31] is describing Figure 6A," Dr. Smith responded affirmatively, "[T]hat's what it -- the paragraph starts off saying Figure 6A shows, so, yes, I believe that's true." EX2040, 53:7-13. When asked whether "this passage, Column 8, 24 to 31, describes Figure 5," Dr. Smith responded negatively, "No. It says

Figure 6A.” EX2040, 53:14-16. This testimony is relevant to Dr. Smith’s prior opinions in EX1049 ¶¶65 and ¶73, regarding thicknesses of films in Figures 5A-5H of Grill, and whether a person of ordinary skill in the art (“POSA”) would have been motivated to combine Grill with Aoyama in the manner proposed by Petitioner. This testimony on cross is relevant because it shows that Dr. Smith improperly imported descriptions from Grill’s embodiment of **Figure 6A** into Grill’s embodiment of **Figures 5A-5H**. Dr. Smith’s testimony on cross that the passage in Grill (EX1005) at 8:24-31 describes Figure 6A, and not Figure 5, contradicts Dr. Smith’s opinion (1) in EX1049 at ¶65 that “*Grill’s* hard mask layers [of Figures 5A-5H] are about 20 to 50 nm thick,” and (2) at ¶73 that “interlevel dielectric layer 58 [of Figures 5A-5H] is only about 20 to 50 nm thick,” because he is deriving those measurements from the portions describing Figure 6.

13. In EX2040, at 53:17-54:11, Dr. Smith testified that he could not recall where the ’696 patent or the ’696 foreign priority document discussed “overetch.” When asked “[d]o you remember seeing the term ‘overetch’ in the ’696 patent?” Dr. Smith responded “I can’t recall.” EX2040, 54:4-6. When asked “[d]o you recall seeing the term ‘overetch’ in the Japanese ’371 application?” Dr. Smith responded “I can’t recall.” EX2040, 54:7-11. This testimony is relevant to the issue of whether the ’696 patent can claim priority to its foreign priority document. In particular, this testimony is relevant to Dr. Smith’s prior opinions at EX1049 ¶¶35-

36 and Petitioner's argument that the '696 patent's foreign priority document (the Japanese '371 application) does not disclose using layer 355 as a mask. *See also* Reply 13-14. Dr. Smith opined that layer 355 was not used as a mask because "those of ordinary skill in the art would have already understood from their training that it would be common for layer 354 to be patterned before completely removing the remnants of second resist pattern 359" in a "technique, called 'overetch.'" EX1049 ¶36. However, Dr. Smith's testimony on cross that he cannot recall the term "overetch" being used in either the '696 patent or the Japanese '371 application is relevant because it shows that in his prior testimony Dr. Smith is importing teachings into the '696 patent and the Japanese '371 application.



Respectfully submitted by:

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**CERTIFICATE OF SERVICE**

The undersigned hereby certifies that this PATENT OWNER'S  
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