

The opinion in support of the decision being entered today was **not** written for publication and is **not** binding precedent of the Board.

Paper No. 13

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* SAMIT SENGUPTA  
and  
TAMMY ZHENG

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Appeal No. 2003-1260  
Application No. 09/850,654

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ON BRIEF

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Before GARRIS, WALTZ, and TIMM, *Administrative Patent Judges*.

TIMM, *Administrative Patent Judge*.

***DECISION ON APPEAL***

This appeal involves claims 1-20 which are all the claims pending in the application. We have jurisdiction over the appeal pursuant to 35 U.S.C. § 134.

### *INTRODUCTION*

The claims are directed to a semiconductor device. Claims 1, 8, and 13 are illustrative:

1. A semiconductor device having a device layer, the semiconductor device comprising:

a via in the device layer of the semiconductor device;

a barrier layer over the device layer and in the via;

metallic material disposed in the via;

a conductive structure formed over the device layer and in contact with the metallic material, the conductive structure having a sidewall extending from a surface of the barrier layer;

a spacer on the sidewall of the conductive structure; and

wherein the metallic material in the via is protected by a spacer on the sidewall of the conductive structure during a removal of a portion of a conducting barrier adjacent to the via and over the device layer.

8. The semiconductor device of claim 7, wherein the metal layer comprises an aluminum alloy.

13. A semiconductor device having a via in a device layer, a barrier layer over the device layer and in the via and metallic material disposed in the via, the semiconductor device comprising:

a conductive structure formed over the device layer and in contact with the metallic material, the conductive structure having at least one sidewall extending from a surface of the metallic material;

a spacer on the sidewall of the conductive structure; and

wherein the metallic material in the via is protected by a spacer on the sidewall of the conductive structure during a removal of a portion of a conducting barrier adjacent to the via and over the device layer.

The claims are rejected over prior art. As evidence of unpatentability, the Examiner relies upon the following prior art references:

Kimizuka et al. (Kimizuka) 5,877,082 Mar. 2, 1999  
(filed May 5, 1997)

Hsu et al. (Hsu) 6,323,553 Nov. 27, 2001  
(effective filing date Feb. 3, 1997)

The specific rejections are as follows:

1. Claims 1-7, 10-17, 19, and 20 stand rejected under 35 U.S.C. § 102(a) as being anticipated by Kimizuka.
2. Claims 8, 9, and 18 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kimizuka in view of Hsu.

In the Grouping of Claims section of the Brief (§ VII), Appellants present six groups of claims and state that the claims do not stand or fall together (Brief, p. 3). The six groups are as follows:

Group 1: claims 1, 2, 4-7, and 10-12.

Group 2: claims 3 and 15.

Group 3: claims 8, 9, and 18.

Group 4: claim 13.

Group 5: claim 14.

Group 6: claims 16-20.

Appellants, however, have not explained why each of the groups of claims is separately patentable in a manner which accords with 37 CFR § 1.192(c)(8)(2001). While Appellants include a paragraph in the Argument section of the Brief (§ VIII) in which they state, for each group of claims, that the claims are separately patentable followed by a discussion of various limitations in those claims (Brief, p. 3), such statements merely point out differences in what the claims cover. But “[m]erely pointing out differences in what the claims cover is not an argument as to why the claims are separately patentable.” 37 CFR § 1.192(c)(7)(2001). To assure separate review, Appellants must additionally identify, for each group, the reasons why the examiner's rejection should not be sustained. *In re McDaniel*, 293 F.3d 1379, 1383, 63 USPQ2d 1462, 1465 (Fed. Cir. 2002). This requires a discussion of the errors in the rejection and the differences between the claims and the prior art for each group.

While Appellants provide reasons for some of the separately grouped claims (Brief, p. 5), we find no such reasons presented for Group 2. The claims of Group 2, therefore, will not be considered separately, they will stand or fall with the claim from which they depend, i.e., claim 3 will stand or fall with claims 1 and 2 and claim 15 will stand or fall with claim 13. We select one claim from each of the separately argued groups to represent the issues on appeal. For Group 1, we select claim 1. For Group 3, we select claim 8. For Group 4, we select claim 13. For Group 6, we select claim 16.

We affirm with respect to both rejections for the following reasons.

***OPINION***

***Anticipation by Kimizuka***

Claims 1-7, 10-17, 19, and 20 stand rejected under 35 U.S.C. § 102(a) as anticipated by Kimizuka.<sup>1</sup> The issues with respect to this rejection involve the claims of Groups 1 and 4-6.

***Group 1***

We have selected claim 1 to represent the issues on appeal for Group 1. Claim 1 is directed to a semiconductor device which, among other things, has a spacer on the sidewall of a conductive structure. Looking particularly at Figure 4F of Kimizuka, we, like the Examiner, find no difference in structure between the device of Kimizuka and that of claim 1. As Kimizuka discloses every limitation of the claimed invention, either explicitly or inherently, Kimizuka describes a semiconductor device that anticipates the claimed device. *See In re Schreiber*, 128 F.3d 1473, 1477, 44 USPQ2d 1429, 1431 (Fed. Cir. 1997).

Appellants argue that Kimizuka does not describe a spacer (Brief, p. 4). But we agree with the Examiner that sidewall insulating films 13 are spacers (Answer, p. 3). Sidewall insulating films 13 are in the location required by claim 1 and formed from silicon oxide, a material described in the specification as appropriate for the spacer (Compare Kimizuka, col. 6, ll. 25-29 with the specification, p. 9, ll. 23-29).

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<sup>1</sup>The question of whether § 102(a) was the appropriate section of the statute under which to make the rejection has not been raised on this appeal. Other than to note that Kimizuka clearly qualifies as prior art under § 102(e), we will not consider the question in light of the lack of dispute.

Appellants also argue that sidewall insulating film 13 would not protect metal 8 during removal of a portion of the conducting barrier 7 adjacent to the via and over the layer 5 (Brief, p. 4). In other words, Appellants argue that the insulating film 13 of Kimizuka does not perform the claimed function of protecting the metallic material in the via as recited in claim 1. This is a functional limitation as acknowledged by Appellants (Brief, p 5).

We emphasize that the claim is directed to a semiconductor device. While Appellants are free to define the device by what it does rather than by what it is, *In re Swinehart*, 439 F.2d 210, 212, 169 USPQ 226, 228 (CCPA 1971), such a method of claim drafting carries the risk that the claims will not distinguish the structure from that of the prior art. *Schreiber*, 128 F.3d at 1478, 44 USPQ2d at 1432. The absence of a disclosure relating to function does not defeat a finding of anticipation if the structure is the same. *Schreiber*, 128 F.3d at 1477, 44 USPQ2d at 1431.

There is reason to conclude that insulating films 13 of Kimizuka are inherently capable of performing the function claimed. Insulating films 13 are formed along the sidewalls of the conductive structures 9. The location puts more distance between the metallic material in the via and any etching operation on the barrier layer. This is a protective location. The insulating films 13 are formed from silicon oxide, a material Appellants describe as useful for their spacers (specification, p. 9, l. 28). Given the location and composition of the insulating films 13, it is reasonable to conclude that the insulating films 13 would inherently function in the protective manner claimed. *See In re Spada*, 911 F.2d 705, 708, 15 USPQ2d 1655, 1657-58 (Fed. Cir. 1990); *In re Best*, 562 F.2d 1252, 1254, 195 USPQ 430, 433-34 (CCPA 1977). If the prior art

structure possesses all the claimed characteristics including the capability of performing the claimed function, then there is a *prima facie* case of unpatentability. *In re Ludtke*, 441 F.2d 660, 663-64, 169 USPQ 563, 566-67 (CCPA 1971).

Given that there is a reasonable basis to believe that the device of Kimizuka is capable of functioning as claimed, it is reasonable to shift the burden to Appellants to prove that, in fact, the prior art device is not so capable. *Best*, 562 F.2d at 1254, 195 USPQ at 433. Appellants do not provide any objective evidence of a patentable difference in structure.

Appellants seem to believe that the functional clause of the claim limits the claim to placing the spacer over the metallic material in the via (Brief, p. 4). The claim is not so limited: it requires placement for protection and this encompasses the placement of Kimizuka.

Even if the claim did require placing the spacer over the metallic material in the via, Kimizuka would anticipate. As acknowledged in the “Background of Invention” section of Appellants’ specification, aggressive design rules used in the prior art result in incomplete overlap of conductive lines with underlying vias (specification, 2, ll. 5-6). Kimizuka is directed to semiconductor devices with fine patterns and high density integration (col. 1, ll. 14-18, col. 2, ll. 32-33, and col. 7, ll. 13-15). Incomplete overlap will occur in the devices of Kimizuka. Differences in overlap inherently result in insulating films 13 over, and in contact with, metallic material 8.

We conclude that the Examiner has established a *prima facie* case of anticipation with respect to the subject matter of claims 1-7 and 10-12 which has not been sufficiently rebutted by Appellants.

***Group 4***

Group 4 contains claims 13 and 15. Our focus will be on representative claim 13. Claim 13 requires, among other things, “a conductive structure formed over the device layer and in contact with the metallic material, the conductive structure having at least one sidewall extending from a surface of the metallic material.”

Appellants argue that “the Examiner failed to cite a portion of [Kimizuka] that teaches or suggests a conductive structure over the device layer, in contact with the metallic material and having at least one sidewall extending from a surface of the metallic material.” (Brief, p. 5). Figure 4F clearly shows a conductive structure 9 over the device layer 5 and in contact with the metallic material 8. As we discussed above, we find that spacer contact with the metallic material occurs in the known aggressively designed devices and would inherently be present in the device of Kimizuka.

We conclude that the Examiner has established a *prima facie* case of anticipation with respect to the subject matter of claims 13 and 15 which has not been sufficiently rebutted by Appellants.

***Group 5***

The sole claim within group 5 is claim 14. Claim 14 is dependent on claim 13 and further requires that the spacer be in contact with the surface metallic material disposed in the via.

With regard to claim 14, Appellants argue that “the Examiner failed to cite a portion of [Kimizuka] that teaches or suggests a spacer being in contact with a metallic material disposed in a via.” (Brief, p. 5). Again, the film 13 of Kimizuka will inherently be in contact with the metallic material 8 within the via in locations where the conductive structure is offset from the via as inherently occurs in the device.

We conclude that the Examiner has established a *prima facie* case of anticipation with respect to the subject matter of claim 14 which has not been sufficiently rebutted by Appellants.

**Group 6**

Group 6 includes claims 16-20 and we have selected claim 16 as representative of the issues on appeal with regard to this group. Claim 16 requires, among other things, “a conductive structure formed over the device layer in contact with, but not completely covering the metallic material disposed in the via, the conductive structure having at least one sidewall extending from a surface of the metallic material.” This limitation is similar to that discussed above with respect to claim 13 and Appellants argued claims 13 and 16 together with respect to this limitation. We sufficiently address the argument above in our discussion of Group 4.

Claim 16 also requires that “the conductive structure and spacer on each of the at least one sidewall, enclose the metallic material in the via.” Appellants further argue that “the Examiner failed to cite a portion of [Kimizuka] that teaches or suggests a conductive structure

and a spacer that enclose metallic material in a via.” (Brief, p. 5). The conductive structure 9 and film 13 sit above metallic film 8 in the via. Film 13 is an insulating film meant to prevent the flow of electrically charged particles into the conductive materials during plasma etching (plasma damage). Film 13 surrounds conductive structure 9. Together, the two structures 9 and 13 “enclose” the metallic material in the via as claimed.

We conclude that the Examiner has established a *prima facie* case of anticipation with respect to the subject matter of claims 16-20 which has not been sufficiently rebutted by Appellants.

### ***Obviousness***

Claims 8, 9, and 18 stand rejected under 35 U.S.C. § 103(a) as obvious over Kimizuka in view of Hsu. As these claims stand or fall together, we select one claim, claim 8, to represent the issues on appeal. Claim 8 requires that the metal in the via be an aluminum alloy.

The Examiner acknowledges that Kimizuka does not specifically disclose the use of an aluminum alloy in the via. The Examiner correctly notes that Kimizuka specifies the use of tungsten in the specific embodiment of Figure 4. We, however, note that Kimizuka does not restrict the metal to tungsten. In fact, the Summary of Invention describes the material as a “contact conductive film” (Kimizuka, col. 3, ll. 7-11, ll. 21-25, and l. 32). Tungsten is simply one example of a known contact conductive film.

The Examiner looks to Hsu as evidence that aluminum alloys have been used in the prior art to fill vias. Indeed, Hsu describes tungsten as an alternative to aluminum systems for filling

vias (Hsu, col. 1, ll. 44-47). Hsu also indicates that aluminum systems typically include copper as an alloying metal to improve electromigration resistance (Hsu, col. 5, ll. 28-30).

Based on the evidence contained in Kimizuka and Hsu, we agree with the Examiner that it would have been obvious to one of ordinary skill in the art at the time of the invention to use an aluminum alloy in the via of Kimizuka. Hsu indicates that the two materials were known alternatives for this use.

Appellants point out that Hsu fails to teach or suggest that the aluminum layer 520 has a sidewall that extends from a barrier layer (Brief, p. 6). Hsu is focused on via filling and not on the structures built atop the via. The fact that Hsu does not describe the additional structure does not mean the structure is nonobvious: Kimizuka provides the required description of the conductive structure and spacer arrangement above the via.

Appellants further argue that the replacement of the tungsten film 8 and the aluminum film 9 with the aluminum layer 520 of Hsu would eliminate the purpose of the Kimizuka reference that includes the sidewall silicon oxide insulating film 13 and the sidewalls of the aluminum film 9 (Brief, p. 6). We fail to see how replacing tungsten with an aluminum alloy eliminates the purpose of Kimizuka. The structure would still contain the filled via 8, conductive structure 9 and insulating film 13. The purpose of Kimizuka is to provide insulating films 13 to protect the conductive structure 9 and prevent charged particles from entering the conductive materials and migrating to the gate oxide film 3 during plasma etching. That purpose, and thus

the insulating films 13, would still be required whether the metallic material used was tungsten or aluminum alloy.

Appellants argue that the Examiner failed to cite evidence in the prior art of a motivation for making the asserted modifications to the Kimizuka device (Brief, p. 7). But Hsu indicates that aluminum systems were thought to be extremely attractive for filling vias (Hsu, col. 1, ll. 44-48). That portion of Hsu also characterizes tungsten as an alternative to aluminum systems (*Id.*). Kimizuka leaves the door open to the use of other conductive materials given that the teaching of tungsten is merely within a specific embodiment of Kimizuka and Kimizuka more broadly identifies the via material as a “contact conductive film.” We, therefore, agree with the Examiner that there is a sufficient suggestion in the prior art for the use of aluminum alloy in the via of Kimizuka.

As a final point, we note that Appellants base no arguments upon objective evidence of non-obviousness such as unexpected results. We conclude that the Examiner has established a *prima facie* case of obviousness with respect to the subject matter of claims 8, 9, and 18 which has not been sufficiently rebutted by Appellants.

#### ***OTHER ISSUES***

Should claim 20 be subjected to further prosecution, the Examiner should consider whether claim 20 meets the written description requirement of 35 U.S.C. § 112, ¶ 1. Claim 20 requires that “all sidewalls of the conductive structure extend from the surface of the metallic

material, each sidewall having a spacer disposed thereon, and each spacer being in contact with the metallic material.” The specification describes conductive structures 114 that “may or may not be aligned with the underlying via structures 109, as illustrated in Figure 1C.” But differences in alignment do not necessarily translate to differences in size such that the conductive structure with all its sidewalls extend from the surface of the metallic material in the via. Such an arrangement would require the diameter or width of the conductive structure to be smaller in all directions than the via. It is not clear that such a size difference was described in the original written description.

#### ***CONCLUSION***

To summarize, the decision of the Examiner to reject claims 1-7, 10-17, 19, and 20 under 35 U.S.C. § 102(a) and claims 8, 9, and 18 under 35 U.S.C. § 103(a) is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a).

AFFIRMED

BRADLEY R. GARRIS	)	
Administrative Patent Judge	)	
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	)	BOARD OF PATENT
THOMAS A. WALTZ	)	APPEALS
Administrative Patent Judge	)	AND
	)	INTERFERENCES
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