

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* WILLIAM J. SCHAFF, JEONGHYUN HWANG, and  
BRUCE M. GREEN

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Appeal 2008-3195  
Application 09/858,337  
Technology Center 2800

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Decided: December 8, 2008

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Before MAHSHID D. SAADAT, JOHN A. JEFFERY, and KEVIN F.  
TURNER, *Administrative Patent Judges*.

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DECISION ON APPEAL

STATEMENT OF THE CASE

Appellants appeal under 35 U.S.C. § 134 from the Final Rejection of claims 1-9 and 11-15. We have jurisdiction under 35 U.S.C. § 6(b). We affirm.

Appellants' claimed invention relates to heterojunction field effect transistors, to the use of aluminum nitride to coat such transistors for

improved performance, and to methods of forming such AlN coatings.  
(Spec. 1:17-18).

Independent claim 1 is illustrative of the invention and reads as follows:

1. A method of forming a field effect transistor, the method comprising:  
  
forming a channel heterojunction field effect transistor having a top surface; and  
  
applying an AlN passivation layer to the top surface of the heterojunction channel field effect transistor.

The Examiner relies on the following prior art references to show unpatentability:

Parmenter	US 5,026,454	Jun. 25, 1991
Utumi	US 5,571,603	Nov. 5, 1996
Huang	US 5,719,088	Feb. 17, 1998
Yoshida	US 6,281,099 B1	Aug. 28, 2001 (filed Mar. 6, 2000)

Claim 1 stands rejected under 35 U.S.C. § 102(b) as being anticipated by Huang.

Claims 2, 5, and 9 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Huang and Yoshita.

Claims 3 and 4 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Huang and Parmenter.

Claims 6-8 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Huang, Yoshita, and Parmenter.

Claims 11-15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Utumi, Parmenter, and Yoshita.

Claims 1-19 are pending in the application, where claims 17-19 have been allowed and claims 10 and 16 were objected to as being dependent on rejected base claims but containing allowable subject matter. Appellants also acknowledge that claim 4 should depend from claim 3, instead of claim 1 as recited, and indicate that claim 4 will be amended to correct the antecedent basis issue in claim 4. (App. Br. 14).

Rather than reiterate the arguments of Appellants and the Examiner, reference is made to the Briefs and Answer for the respective details. Only those arguments actually made by Appellants have been considered in this decision. Arguments which Appellants could have made but chose not to make in the Briefs have not been considered and are deemed to be waived. *See 37 C.F.R. § 41.37(c)(1)(vii).*

## ISSUES

(i) Under 35 U.S.C. § 102(b), with respect to appealed claim 1, does Huang disclose all of the elements of that claim to render it anticipated?

(ii) Under 35 U.S.C. § 103(a), with respect to appealed claim 2, 5, and 9, would one of ordinary skill in the art at the time of the invention have found it obvious to combine Huang and Yoshita to render the claimed invention unpatentable?

(iii) Under 35 U.S.C. § 103(a), with respect to appealed claims 3 and 4, would one of ordinary skill in the art at the time of the invention have found it obvious to combine Huang and Parmenter to render the claimed invention unpatentable?

(iv) Under 35 U.S.C. § 103(a), with respect to appealed claims 6-8, would one of ordinary skill in the art at the time of the invention have found

it obvious to combine Huang, Yoshita, and Parmenter to render the claimed invention unpatentable?

(v) Under 35 U.S.C. § 103(a), with respect to appealed claims 11-15, would one of ordinary skill in the art at the time of the invention have found it obvious to combine Utumi, Parmenter, and Yoshita to render the claimed invention unpatentable?

### FINDINGS OF FACT

1. Independent claims 1 and 5 recite, in part, an “AlN passivation layer.” Appellants’ Specification fails to define the term “passivation layer.”

2. We construe the term “passivation layer” to be a layer that passivates an underlying layer, as a broad, reasonable definition of that term. One of ordinary skill in the art would recognize that the purpose of passivation is to reduce the chemical reactivity of the underlying layer or to protect against contamination and mechanical damage.

3. Huang details a method of fabricating semiconductor devices with a passivated surface. The underlying substrate is disclosed to be used to form various forms of field effect transistors. A part of the process includes the deposition of a SiN layer (22), followed by deposition of AlN (25) and SiO<sub>2</sub> (26) layers thereon. It is clear that the AlN layer is deposited on a top surface during at least a portion of the formation process. (Col. 2, ll. 43-56; col. 3, ll. 6-42; Figs. 1-6).

4. In Huang, the AlN layer can be said to passivate the underlying SiN layer in that it reduces the chemical reactivity of that SiN layer and protects against contamination thereof.

5. While Huang details a passivation layer (35) which is formed through reaction of the substrate with the gaseous form of a sulfide, fluoride or oxide, the discussion therein does not preclude other layers in the formation process also acting as passivating layers. (Col. 4, ll. 10-35).

6. Utumi details that aluminum nitride films can be formed through conventional molecular beam epitaxy (MBE) processes. The aluminum source can be supplied with an electron beam evaporation source or with a K cell. The nitrogen source, such as N<sub>2</sub> or NH<sub>3</sub>, can be supplied with an ECR ion source or an RF ion source. The temperature of the substrate on crystal growth is generally from 25° to 1,300° C. (Col. 6, l. 62 – col. 7, l. 12).

7. Yoshita details the formation crystal AlN thin films by MBE. Yoshita also details that such ALN films have film thicknesses of about 500-10,000Å. (Col. 2, ll. 45-48; Col. 3, ll. 5-7).

8. Paramenter discloses that MBE methods include alternately opening and closing a molecular or atomic beam source by moving a shutter between an open position and a closed position. Typically the shutter is moved to open (or to close) the beam source within an opening time (or a closing time) and the beam source may remain open (or closed) between movements for any length of time required by the deposition process. (Col. 2, ll. 52-65).

#### PRINCIPLES OF LAW

“A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” *Verdegaal Bros., Inc. v. Union Oil Co.*, 814 F.2d 628, 631 (Fed. Cir. 1987). In rejecting claims under 35 U.S.C. § 103, it is incumbent

upon the Examiner to establish a factual basis to support the legal conclusion of obviousness. *See In re Fine*, 837 F.2d 1071, 1073 (Fed. Cir. 1988).

[T]here must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness' . . . [H]owever, the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.

*KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1741 (2007) (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

During examination, the claims must be interpreted as broadly as their terms reasonably allow. *In re Am. Acad. of Sci. Tech Center*, 367 F.3d 1359, 1369 (Fed. Cir. 2004). When the specification states the meaning that a term in the claim is intended to have, the claim is examined using that meaning, in order to achieve a complete exploration of the applicant's invention and its relation to the prior art. *In re Zletz*, 893 F.2d 319, 321-22 (Fed. Cir. 1989). “Even when guidance is not provided in explicit definitional format, the specification may define claim terms by implication such that the meaning may be found in or ascertained by a reading of the patent documents.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1321 (Fed. Cir. 2005) (citations and internal quotation marks omitted).

## ANALYSIS

### *I. Anticipation by Huang*

#### *Claim 1*

Appellants argue that Huang fails to teach all of the elements of claim 1 because Huang teaches an AlN layer which is used as an etch stop but is

never used as a passivation layer. (App. Br. 9). However, Appellant's Specification does not define the term "passivation layer," (FF. 1), and under the definition of "passivation layer" that we have adopted, (FF. 2), the AlN layer in Huang acts as a passivation layer with respect to underlying layers. (FF. 4). In addition, Appellants argue that Huang discloses other passivation layers which are very different from Huang's AlN layer and the claimed AlN passivation layer, and that disclosure teaches away from having Huang's AlN layer function as a passivation layer. (App. Br. 10). However, given the anticipation rejection of claim 1, the teaching away of Huang's disclosure is immaterial. The salient point is whether the AlN layer in Huang can properly found to be a passivation layer in the context of the present application, which we find it does. (FF. 4). The fact that Huang describes certain layers as passivation layers does not preclude other layers from also falling within the scope that claim term.

Appellants also argue that the Specification makes it clear that the passivation layer is formed directly on top of the HFET and not on additional layers. (App. Br. 10). Even if we were to accept Appellant's finding with respect to the Specification, claim 1 does not contain such language; claim 1 merely recites that the AlN passivation layer is applied to the top surface of the HFET, where no direct formation is recited. Similarly, Appellants argue that a passivation layer must alter the electronic properties of the surface of the transistor and stop uncontrolled changing of charge states at the surface during operation of the transistor. (App. Br. 10-11). These purported functions of the passivation layer are also not recited in claim 1, where only the recitation of the passivation layer can be relied upon

for its function. As such, we do not find Appellants' arguments with respect to claim 1 to be compelling.

*II. Obviousness over Huang and Yoshita*  
*Claims 2, 5, and 9*

Appellants argue that Yoshita fails to teach or suggest the formation of an AlN passivation layer, regardless of thickness. Appellants also argue that neither Huang nor Yoshita discloses the use of MBE to form an AlN passivation layer. (App. Br. 13). However, as the Examiner has found, the formation of the AlN passivation layer, discussed *supra*, allows for optimization of that layer thickness in view of Yoshita. (Ans. 8). Yoshita provides for thicknesses that cover the thicknesses recited in claims 2 and 9. (FF 7). Additionally, Yoshita discloses the formation of such a layer through MBE, (FF 7), such that we do not find Appellants' argument that neither cited reference discloses the formation of an AlN passivation layer by MBE to be persuasive.

*III. Obviousness over Huang and Parmenter*  
*Claims 3 and 4*

Appellants reiterate the arguments expressed with respect to claim 1 to the rejection of claims 3 and 4, which we do not find to be compelling. (App. Br. 13-14). Additionally, Appellants argue that while Parmenter describes several beam sources, each having a shutter and a control mechanism, Parmenter fails to discuss the formation of compound materials. (App. Br. 14). Appellants suggest that Parmenter only discloses the alternate opening and closing of a single shutter, and does not alternate

between two shutters to form a compound layer. However, as the Examiner finds, (Ans. 8-9), Paramenter discloses that the system may dose a substrate with several materials, in sequence or simultaneously. (FF. 8). The formation of compound layers would follow in view of Huang.

In addition, Appellants argue that neither Huang nor Paramenter discloses that a predetermined amount of time occurs between each alternate application. (App. Br. 14). We agree with the Examiner, however, that the discussion in Paramenter of dosing the beam sources in sequence necessarily requires some amount of time between those applications, and that meets the requirements of claim 4. (Ans. 9, FF. 8). As such, we do not find Appellants' arguments with respect to claims 3 and 4 to be compelling.

*IV. Obviousness over Huang, Yoshita, and Parmenter*  
*Claims 6-8*

Appellants reiterate the arguments expressed with respect to claims 1, 4, and 5 to the rejection of claims 6-8, which we do not find to be compelling. (App. Br. 14-15). Additionally, Appellants argue that while Paramenter refers to controlling how fast the shutter opens and closes, it does not describe the length of time that a shutter is open as claimed in claim 6. (App. Br. 15). The Examiner responds that Paramenter discloses that the shutter may remain open between movements for any length of time, (FF. 8), and that renders obvious the specific time limits provided in claims 6-8. (Ans. 9-10). We agree with the Examiner's findings. As such, we do not find Appellants' arguments with respect to claims 6-8 to be compelling.

V. *Obviousness over Utumi, Parmenter, and Yoshita*  
*Claims 11-15*

Appellants argue that Paramenter fails to teach alternatively applying different beams to arrive at a two compound layer such as AlN. (App. Br. 16). However, as discussed *supra*, we find that the Examiner has shown Paramenter discloses that the system may dose a substrate with several materials, in sequence or simultaneously, (FF. 8), and that this is sufficient to render the formation of compound layer, in view of Utumi and Yoshita, obvious. (Ans. 16).

In addition, Appellants argue that the cited references are not combinable, and that there is no suggestion from the references found to make the combination. (App. Br. 16). We find, however, the rationale supplied in the rejection sufficient to motivate the combination. (Ans. 12). Appellants suggest that since there is no suggestion in Utumi for accurate dosage, the Examiner's motivation to combine the references is conclusory and cannot serve as objective evidence for a suggestion or motivation to combine the references. (App. Br. 17). However, as the Examiner has found, (Ans. 12), there is sufficient disclosure to suggest the combination. Appellants appear to suggest that since Paramenter motivates greater accuracy, there must be an express suggestion in Utumi for such accuracy in order for there to be specific, objective evidence of a motivation to combine the references. We reject such a test for determining the propriety of a combination of references. As such, we find no error in the formation of the rejection of claims 11-15.

### CONCLUSION

The decision of the Examiner rejecting claim 1 under 35 U.S.C. § 102(b) based on Huang, rejecting claims 2, 5, and 9 under 35 U.S.C. § 103(a) as being unpatentable over Huang and Yoshita, rejecting claims 3 and 4 under 35 U.S.C. § 103(a) as being unpatentable over Huang and Parmenter, rejecting claims 6-8 under 35 U.S.C. § 103(a) as being unpatentable over Huang, Yoshita, and Parmenter, and claims 11-15 under 35 U.S.C. § 103(a) as being unpatentable over Utumi, Parmenter, and Yoshita, is affirmed.

### DECISION

The Examiner's rejections of claims 1-9 and 11-15 before us on appeal are affirmed.

### AFFIRMED

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