

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* CHIEN M. WAI,  
HIROYUKI OHDE,  
and STEPHEN J. KRAMER

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Appeal 2008-3963  
Application 11/038,683  
Technology Center 1700

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Decided: September 30, 2008

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Before CHUNG K. PAK, PETER F. KRATZ and LINDA M. GAUDETTE,  
*Administrative Patent Judges.*

PAK, *Administrative Patent Judge.*

DECISION ON APPEAL

This is a decision on an appeal under 35 U.S.C. § 134 from the Examiner's final rejection of claims 1 through 25, all of the pending claims in the above-identified application. We have jurisdiction pursuant to 35 U.S.C. § 6.

We AFFIRM.

*STATEMENT OF THE CASE*

The subject matter on appeal is directed to methods of treating semiconductor substrates retained proximate the top interior surface of a reaction chamber utilizing supercritical fluids (Spec. 1, paras. 0001 and 0012-0014). Details of the appealed subject matter are recited in representative claims 1, 8, and 18 reproduced below<sup>1</sup>:

1. A method of treating a semiconductor substrate, comprising:

providing an apparatus comprising a reaction chamber; the reaction chamber including an interior periphery that comprises a bottom region, a top region, and one or more sidewall regions between the bottom region and top region; the reaction chamber being oriented in a gravitational field such that the field pulls from the top region toward the bottom region;

attaching a semiconductor substrate to one of the regions of the interior periphery other than the bottom region; and

treating the attached semiconductor substrate by exposing the semiconductor substrate to a supercritical fluid having one or more reactants dispersed therein.

8. A method of treating a semiconductor substrate, comprising:

providing an apparatus comprising a reaction chamber; the reaction chamber comprising an interior periphery that includes a bottom half and a top half; the reaction chamber being oriented in a gravitational field such that the field pulls from the top half toward the bottom half;

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<sup>1</sup> Appellants have presented substantive arguments for patentability of claims 1, 8, and 18 (App. Br. 9-15). Therefore, for purposes of this appeal, we select claims 1, 8, and 18 and decide the propriety of the grounds of rejection set forth in the Answer based on these representative claims consistent with 37 C.F.R. § 41.37(c)(1) (vii) (2005).

retaining a semiconductor substrate within the top half of the interior periphery; and

while the semiconductor substrate is retained within the top half of the interior periphery, exposing the semiconductor substrate to a supercritical fluid having one or more reactants dispersed therein to treat the semiconductor substrate.

18. A method of treating a semiconductor substrate, comprising:

providing an apparatus comprising a reaction chamber; the reaction chamber comprising a bottom interior surface and a top interior surface; the reaction chamber being oriented in a gravitational field such that the field pulls from the top interior surface toward the bottom interior surface;

retaining a semiconductor substrate proximate the top interior surface; the substrate having surface which is to be treated and said substrate surface facing downwardly within the reaction chamber toward the bottom interior surface;

heating the retained semiconductor substrate; and

while the semiconductor substrate is retained and heated, exposing the semiconductor substrate surface to a supercritical fluid having one or more reactants dispersed therein to treat the semiconductor substrate surface.

As evidence of obviousness of the appealed subject matter, the Examiner has proffered the following prior art references:

Kroneberger	6,287,385 B1	Sep. 11, 2001
Olgado	6,736,408 B2	May 18, 2004
Sasaki	2004/0250747 A1	Dec. 16, 2004

Appellants' admission at pages 1 through 3 of the Specification (hereinafter referred to as "the admitted prior art").

The Examiner has rejected claims 1 through 25 under 35 U.S.C. § 103(a) as unpatentable over the combined teachings of Sasaki and the admitted prior art.

Appellants appeal from the Examiner's decision rejecting the claims on appeal under 35 U.S.C. § 103(a).

*PRINCIPLES OF LAW, ANALYSIS AND ISSUE*

Under 35 U.S.C. § 103, the factual inquiry into obviousness requires a determination of: (1) the scope and content of the prior art; (2) the differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) secondary considerations, if any. *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966). “[A]nalysis [of whether the subject matter of a claim would have been *prima facie* obvious] 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, 1740-41 (2007); ); *see also DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1361 (Fed. Cir. 2006) (“The motivation need not be found in the references sought to be combined, but may be found in any number of sources, including common knowledge, the prior art as a whole, or the nature of the problem itself...”); *In re Bozek*, 416 F.2d 1385, 1390 (CCPA 1969)(“Having established that this knowledge was in the art, the examiner could then properly rely, as put forth by the solicitor, on a conclusion of obviousness ‘from common knowledge and common sense of the person of ordinary skill in the art without any specific hint or suggestion in a particular

reference.””). The common knowledge imputed to the level of one of ordinary skill in the art includes Appellant’s admission regarding what was known at the time of the invention. *See In re Nomiya*, 509 F.2d 566, 570-71 (CCPA 1975) (the admitted prior art in an Applicant’s Specification may be used in determining the patentability of a claimed invention); *see also In re Fout*, 675 F.2d 297, 301 (CCPA 1982) (“[i]t is not unfair or contrary to the policy of the patent system that appellants’ invention be judged on obviousness against their actual contribution to the art”).

Here, Appellants do not dispute the Examiner’s finding that:

Sasaki describes a method for treating a semiconductor substrate comprising: providing a reactive chamber having a ceiling (claimed top region), a bottom and sidewall regions and the chamber is oriented in a gravitational field (earth gravitational field), which would pull the ceiling region toward the bottom (fig. 2A; paragraph [0074]); attaching the substrate to the ceiling of the chamber and treating the substrate by exposing it to a reactive gas mixture (paragraph [0075]).

[Compare Ans. 3 with App. Br. 4-13 and Reply Br.1-8]

Rather, Appellants contend that one of ordinary skill in the art would not have been led to employ the claimed supercritical fluid having one or more reactants dispersed therein in Sasaki’s semiconductor processing chamber as required by claims 1, 8, and 18 (App. Br. 4-14 and Reply Br. 1-8).

Therefore, the dispositive question is: Would one of ordinary skill in the art have been led to employ the claimed supercritical fluid having one or more reactants dispersed therein in Sasaki’s semiconductor processing chamber as required by claims 1, 8, and 18? On this record, we answer this question in the affirmative.

We find that Sasaki teaches that “[t]he thin film of Group III nitride single crystal can be formed on the [semiconductor] substrate, e.g., by metal

organic *chemical vapor deposition* (MOCVD)...” (p. 3, para. 0062) (emphasis added). Although Sasaki does not mention employing the claimed supercritical fluid, the Examiner finds (Ans. 3 and 5) that

[T]he Admitted prior art shows that using supercritical fluid...in the manufacturing of a semiconductor substrate, such as etching or *depositing*, is well known to one skilled in the art at the time of the invention (pages 1-3 of the specification).

....

[T][he Admitted prior art teaches that supercritical fluid can have higher diffusion coefficients than conventional solvents, which can enhance chemical reactions occurring therein (page 1 of the specification, paragraph 0003).

....

Supercritical fluids possess property of gas and have high diffusivity and known to use in numerous applications in *semiconductor processing including deposition of substances* over semiconductor surfaces. It also enhances chemical reactions occurring therein (admitted prior art, page 1 of the specification, paragraphs 0002, 0003, 0005). [Emphasis added.]

Appellants have not disputed the Examiner’s finding that the above information in the Background of the Invention section of the Specification was known to those skilled in the art at the time of the invention (*Compare Ans. 3-5 with App. Br. 4-14 and Reply Br. 1-8*).

Given the above undisputed facts, we are constrained to agree with the Examiner that one of ordinary skill in the art would have been led to employ a mixture of the claimed supercritical fluid and Sasaki’s reactant gas in Sasaki’s semiconductor processing chamber, with a reasonable expectation of improving deposition of a thin film of Group III nitride single crystal on the semiconductor substrate.

In reaching this determination, we note Appellants' arguments directed to possible detrimental intermingling of a reactive gas from a crystal generation region in a material supply region in Sasaki's reaction chamber due to a supercritical fluid having a higher diffusion coefficient than conventional solvents (Reply Br. 4-6). However, we find that Sasaki, in the embodiment referred by Appellants, introduces a reactant gas directly to the semiconductor substrate via a reactive gas inlet pipe 23 so that GaN powder evaporated from a crucible 28 reacts with nitrogen in the reactive gas on the semiconductor substrate (p. 4, paras. 0074 and 0075, and Fig. 2). Consistent with this teaching, one of ordinary skill in the art would have been led to introduce both the reactant gas and the supercritical fluid directly to the targeted semiconductor substrate to promote their reaction and deposition (diffusivity) on the semiconductor substrate, rather than anywhere near the material supply region.

Accordingly, based on the totality of record relied upon by the Examiner and Appellants, including due consideration of Appellants' arguments, we determine that the preponderance of evidence weighs most heavily in favor of obviousness of the subject matter recited in the claims on appeal within the meaning of 35 U.S.C. § 103 (a).

*ORDER*

In view of the foregoing, the decision of the Examiner is affirmed.

Appeal 2008-3963  
Application 11/038,683

*TIME PERIOD*

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

AFFIRMED

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