

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.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. 26

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte GURTEJ S. SANDHU and RANDHIR PS THAKUR

Appeal No. 2001-1697
Application No. 09/059,718

ON BRIEF

Before WALTZ, LIEBERMAN and KRATZ, Administrative Patent Judges.
KRATZ, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal from the examiner's refusal to allow claims 41, 43, 44, 48, 50 and 51, which are all of the claims pending in this application.

BACKGROUND

Appellants' invention relates to a process of forming a dielectric film containing silicon dioxide and silicon nitride on an exposed surface of a silicon-containing layer. The exposed surface is heated and contacted with a gaseous mixture including ozone, nitrous oxide, a compound containing a halogen, and steam.

An understanding of the invention can be derived from a reading of exemplary claim 41, which is reproduced below.

41. A process for forming a dielectric film containing silicon dioxide and silicon nitride on an exposed surface of a layer containing silicon, said process comprising the steps of:

providing a chamber;

determining the desired thickness of a layer of said dielectric film containing silicon dioxide and silicon nitride on said exposed surface of said layer containing silicon;

heating said exposed surface of said layer containing silicon to a temperature in the range of at least 600°C and to 1100°C;

providing a gaseous mixture including nitrous oxide exhibiting a partial pressure, ozone exhibiting a partial pressure, at least one compound containing a halogen selected from the group consisting of Cl₂, Br₂, HCl and HBr, and steam, the partial pressure of the ozone being at least one tenth the partial pressure of the nitros oxide in the gaeous mixture, the gaseous mixture being substantially free of fluorine-containing gases; and

subjecting said exposed surface of a layer containing silicon to the gaseous mixture including at least nitrous oxide, ozone, at least one compound containing a halogen selected from the group consisting of Cl₂, Br₂, HCl and HBr, and steam for a period sufficient to form the dielectric film to the desired thickness.

The prior art references of record relied upon by the examiner in rejecting the appealed claims are:

Fujishiro et al. (Fujishiro)	5,294,571	Mar. 15, 1994
Yamasaki et al. (Yamasaki) ¹	8-78693	Mar. 22, 1996

¹ The examiner refers to this reference as JP '693 and lists the first named inventor's surname as "Yamazaki," which spelling corresponds to the spelling of the first named inventor's surname

(published Japanese Kokai Patent Application)

Kakoschke et al. (Kakoschke)² DE 43 33 160 Mar. 30, 1995
(German Offenlegungsschrift)

Claims 41, 43, 44, 48, 50 and 51 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Yamasaki in view of Fujishiro. Claims 41, 43, 44, 48, 50 and 51 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kakoschke in view of Fujishiro.

We refer to the brief and reply brief and to the answer for a complete exposition of the opposing viewpoints expressed by appellants and the examiner concerning the issues before us in this appeal.

OPINION

We have carefully reviewed the entire record, including all of the arguments and evidence advanced by both the examiner and the appellants in support of their respective positions. This review leads us to conclude that the examiner's rejections are not well founded. Accordingly, we reverse all of the

in a CA abstract. However, all references to Yamasaki in this decision are to the English language translation thereof of record.

² Our reference to Kakoschke in this decision is to the English translation of the Offenlegungsschrift that is present in the application file.

aforementioned rejections. The reasons for our determination follow.

In the rejections stated in the answer, the examiner has identified either Yamasaki or Kakoschke as the closest prior art reference. Appellants have pointed out that, among other things, Yamasaki and Kakoschke each do not teach or suggest the use of steam and a halogen compound together with nitrous oxide and ozone in a gaseous mixture for treating a heated silicon-containing surface of a silicon layer to form a dielectric film containing silicon dioxide and silicon nitride as recited in the appealed claims (see, e.g., appeal brief, page 18).

To remedy that acknowledged deficiency of either Yamasaki or Kakoschke (answer, pages 3-7), the examiner has relied upon Fujishiro. According to the examiner, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include HCl and water in the gaseous oxidizing mixture of either Yamasaki or Kakoschke to enhance the oxidation rate of the silicon layer in either Yamasaki or Kakoschke as taught by Fujishiro at column 5, lines 20-27 thereof.

We cannot agree.

Under 35 U.S.C. § 103(a), the examiner carries the initial burden of establishing a prima facie case of obviousness.

In re Piasecki, 745 F.2d 1468, 1471-72, 223 USPQ 785, 787-88 (Fed. Cir. 1984). As part of meeting this initial burden, the examiner must determine whether the differences between the subject matter of the claims and the prior art "are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art" (emphasis added). 35 U.S.C. § 103(a) (1999); Graham v. John Deere Co., 383 U.S. 1, 14, 148 USPQ 459, 465 (1966).

Here, as pointed out by the appellants in their briefs, the examiner has not established any convincing reason, suggestion or motivation for combining the references so as to arrive at the claimed subject matter. Concerning this matter, the examiner has not carried the burden of reasonably showing why one of ordinary skill in the art would have employed the water and HCl of Fujishiro in the gaseous mixtures used in the processes of either Yamasaki or Kakoschke. More specifically, Yamasaki teaches that the presence of hydrogen containing compounds such as water in the gaseous oxidizer atmosphere would not be compatible with the method disclosed therein since hydrogen would be included in the oxidized film that is formed resulting in charge mobility and other problems. Indeed, Yamasaki teaches that the presence of hydrogen containing compounds such as water should be less than 1

part per million (ppm) of the gaseous oxidizing atmosphere. See numbered paragraphs 10 and 13 at pages 6 and 7 of Yamasaki.

While Fujishiro seemingly suggests that HCl and water may be employed in conventional amounts, such as 2.5 volume percent HCl in the gaseous mixture of Fujishiro for forming a silicon dioxide layer on a semiconductor device at relatively high temperatures of at least 850 °C, such an amount of water or other hydrogen compounds is contraindicated by the teachings of Yamasaki with respect to their process. Also, Yamasaki conducts the oxidation at temperatures of 400-700°C and the examiner has not explained how the teachings of Fujishiro regarding a higher temperature oxidation process would have been perceived as relevant to the Yamasaki process by one of ordinary skill in the art. Hence, the examiner's assertion that one of ordinary skill in the art would have included HCl and water in the gaseous oxidizer of Yamasaki in amounts effective to increase oxidation rates while also taking into account the disadvantages of including as little as 1 ppm hydrogen containing compounds in the gas (answer, page 8) falls short in establishing that such a modification of Yamasaki would have been suggested to one of ordinary skill in the art based on the combined teachings of Yamasaki and Fujishiro. In this regard, the examiner has not established that Fujishiro

would have even suggested to one of ordinary skill in the art that using an infinitesimal amount of HCl and water such that hydrogen amounts to less than 1 ppm of the gaseous atmosphere would have been expected to result in an increased oxidation rate.

Moreover, the examiner's contends (answer, pages 5-7 and 12) that the gaseous mixture of Kakoschke containing nitrous oxide and ozone, which is disclosed as being used in a post-oxidation step to remove hydrogen and not in the silicon oxide layer forming oxidation step, could also be used in the oxidation step of Kakoschke together with the HCl and water of Fujishiro. See the paragraph bridging pages 5 and 6 and Example 2 of Kakoschke.

However, the examiner simply has not adequately explained why one of ordinary skill in the art would turn to the disparate disclosure of Fujishiro and significantly modify the process of Kakoschke by not only adding HCl and water but also adding the post-oxidation nitrous oxide and ozone to the oxidation step of Kakoschke in a fashion so as to arrive at the here claimed subject matter based on the teachings of the references.

Rejections based on § 103(a) must rest on a factual basis with these facts being interpreted without hindsight reconstruction of the invention from the prior art. See In re Warner, 379 F.2d

1011, 1017, 154 USPQ 173, 177 (CCPA 1967), cert. denied, 389 U.S. 1057 (1968). Our reviewing court has repeatedly cautioned against employing hindsight by using the appellants' disclosure as a blueprint to reconstruct the claimed invention from the isolated teachings of the prior art. See, e.g., Grain Processing Corp. v. American Maize-Products Co., 840 F.2d 902, 907, 5 USPQ2d 1788, 1792 (Fed. Cir. 1988).

From our perspective, the examiner's rejections appear to be premised on impermissible hindsight reasoning. On the record of this appeal, it is our view that the examiner has not carried the burden of establishing a prima facie case of obviousness with respect to the subject matter defined by the appealed claims.

Accordingly, we reverse the stated rejections.

CONCLUSION

The decision of the examiner to reject claims 41, 43, 44, 48, 50 and 51 under 35 U.S.C. § 103(a) as being unpatentable over Yamasaki in view of Fujishiro and to reject claims 41, 43, 44, 48, 50 and 51 under 35 U.S.C. § 103(a) as being unpatentable over Kakoschke in view of Fujishiro as stated in the answer is reversed.

REVERSED

THOMAS A. WALTZ)	
Administrative Patent Judge)	
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)	BOARD OF PATENT
PAUL LIEBERMAN)	APPEALS
Administrative Patent Judge)	AND
)	INTERFERENCES
)	
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PETER F. KRATZ)	
Administrative Patent Judge)	

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