The opinion in support of the decision being entered today is *not* binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte SATOSHI KIKUCHI, KOUSAKU MATSUNO,
and HARURU WATATSU

Appeal 2007-2490
Application 09/846,255
Technology Center 2800

Decided: September 19, 2007

Before JOSEPH L. DIXON, ROBERT E. NAPPI, and JOHN A. JEFFERY, *Administrative Patent Judges*.

JEFFERY, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134 from the Examiner's rejection of claims 1-3 and 5-14. We have jurisdiction under 35 U.S.C. § 6(b). We affirm.

STATEMENT OF THE CASE

Appellants invented a cleaning process for selectively removing an unnecessary film from a semiconductor substrate surface, yet leaving another necessary film intact. Specifically, a mixed gas comprising anhydrous hydrogen fluoride (HF) gas and a heated inert gas is continuously brought into contact with the surface of the substrate. As a result, the unnecessary low-density film can be removed without impairing the necessary high-density film beyond a tolerance.[1] Claim 1 is illustrative with the key limitation in dispute emphasized:

> 1. A process for cleaning a surface of a substrate, said surface carrying thereon a high-density film and a low-density film lower in density than said high-density film in combination, which comprises *continuously* bringing a mixed gas comprising anhydrous hydrogen fluoride gas and a heated inert gas into contact with said surface of said substrate such that at least a portion of said low-density film is removed without impairing said high-density film beyond a tolerance, wherein the mixed gas does not contain steam.

[Emphasis added.]

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

Mehta	US 5,635,102	Jun. 3, 1997
Verhaverbeke	US 5,922,624	Jul. 13, 1999

Claims 1-3 and 5-14 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Mehta and Verhaverbeke.

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[1] *See generally* Abstract; Specification 1:4-12 and 10:3-12.

Rather than repeat the arguments of Appellants or the Examiner, we refer to the Briefs and the Answer[2] for their respective details. In this decision, we have considered only those arguments actually made by Appellants. Arguments which Appellants could have made but did not make in the Briefs have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(vii).

OPINION

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, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). In so doing, the Examiner must make the factual determinations set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 17, 148 USPQ 459, 467 (1966).

Discussing the question of obviousness of a patent that claims a combination of known elements, *KSR Int'l v. Teleflex, Inc.*, 127 S. Ct. 1727, 82 USPQ2d 1395 (2007) explains:

> When a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person of ordinary skill can implement a predictable variation, §103 likely bars its patentability. For the same reason, if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill. *Sakraida* [*v. AG*

[2] We refer to the most recent Examiner's Answer, mailed Sept. 1, 2006, throughout this opinion.

> *Pro, Inc.*, 425 U.S. 273, 189 USPQ 449 (1976)] and *Anderson's-Black Rock*[, *Inc. v. Pavement Salvage Co.*, 396 U.S. 57, 163 USPQ 673 (1969)] are illustrative—a court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions.

KSR, 127 S. Ct. at 1740, 82 USPQ2d at 1396. If the claimed subject matter cannot be fairly characterized as involving the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement, a holding of obviousness can be based on a showing that "there was an apparent reason to combine the known elements in the fashion claimed." *Id*., 127 S. Ct. at 1740-41, 82 USPQ2d at 1396. Such a showing requires "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." *Id*., 127 S. Ct. at 1741, 82 USPQ2d at 1396 (quoting *In re Kahn*, 441 F.3d 977, 987, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006)).

If the Examiner's burden is met, the burden then shifts to the Appellants to overcome the prima facie case with argument and/or evidence. Obviousness is then determined on the basis of the evidence as a whole and the relative persuasiveness of the arguments. *See In re Oetiker*, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992).

Independent Claim 1

Regarding independent claim 1, the Examiner's rejection essentially finds that Mehta teaches a substrate surface cleaning method that brings a mixed gas of anhydrous hydrogen fluoride (HF) and heated inert gas into contact with the substrate surface to remove a low-density film without impairing a high-density film, as claimed. According to the Examiner, Mehta teaches every claimed feature except for *continuously* exposing the anhydrous gas with the substrate. The Examiner cites Verhaverbeke as teaching etching using a "dynamic mode," a mode that utilizes a continuous flow of process gases. The Examiner further notes that Verhaverbeke teaches that either pulsing (static) or continuous (dynamic) modes may be used to selectively etch silicon oxides (i.e., they are interchangeable). The Examiner then concludes that it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Mehta to continuously flow process gases (Answer 3-4, 7, and 8).

Appellants argue that although Verhaverbeke discusses both static and dynamic modes in the context of traditional vapor etching techniques, Verhaverbeke prefers the static mode given the reference's overall emphasis on static mode etching (Br. 4-5). In any event, Appellants argue, it is unclear why the skilled artisan would combine Mehta with Verhaverbeke. According to Appellants, Verhaverbeke's preference for the static mode, in essence, teaches away from the dynamic mode. Appellants further contend that not only is Verhaverbeke not concerned with selective removal of a low-density film present with a high-density film, the respective treatment compositions in Mehta and Verhaverbeke are different. According to

Appellants, Verhaverbeke -- unlike Mehta -- contemplates including water and carboxylic acid (Br. 5-7; Reply Br. 3-4).

The Examiner responds that Verhaverbeke does not teach away from the dynamic mode, but rather acknowledges that both the static and dynamic modes have certain drawbacks, but nonetheless are interchangeable techniques. The Examiner notes that Verhaverbeke even claims both such techniques in claims 11 and 12 of the patent respectively (Answer 7).

We will sustain the Examiner's rejection of independent claim 1. As an initial matter, we note that Appellants do not dispute the Examiner's findings that Mehta discloses all limitations of independent claim 1 except for the "continuously" limitation noted above. We therefore adopt these undisputed factual findings regarding the disclosure to Mehta.

However, in our view, the scope and breadth of the term "continuously" as claimed does not preclude the continuous flow of gas that occurs *during the periods when gas is flowed* -- even if such gas is ultimately flowed in an intermittent or pulsed fashion as in Mehta. That is, even in a static mode, gas flows continuously during the time period that gas is flowing (i.e., during the pulse). According to Mehta, these periods can last 8 seconds (Mehta, col. 4, ll. 39-40), but can vary widely depending on a number of factors (Mehta, col. 3, ll. 52-57) -- a variance which suggests that the time periods could be even longer.

In short, "continuously" is a relative term that can be reasonably interpreted with respect to the specific interval in which gas is flowed. For this reason alone, and since Mehta discloses all other recited limitations of independent claim 1, Appellants have not persuasively rebutted the

Examiner's prima facie case of obviousness of that claim based on the collective teachings of the cited references.

Nevertheless, we find that Verhaverbeke's teaching of continuously flowing process gas in a semiconductor etching process would have been reasonably combinable with Mehta's etching method. Although Verhaverbeke discusses static and dynamic modes[3] in the context of traditional HF vapor etching techniques using HF and water vapors (Verhaverbeke, col. 2, ll. 1-12; col. 3, ll. 7-28), the reference hardly discards the dynamic mode in favor of the static mode as Appellants seem to suggest. As the Examiner indicates, Verhaverbeke actually *claims* performing the etching process in both the static and dynamic modes in different claims respectively (Verhaverbeke, col. 8, ll. 23-38 (claims 11 and 12)).

We recognize that Verhaverbeke's sole example uses the static mode (Verhaverbeke, col. 5, l. 55 - col. 6, l. 30). But merely describing a single exemplary procedure using the static mode in the Specification hardly teaches away from using the dynamic mode. On the contrary, Verhaverbeke clearly recognizes the significance of each technique (static and dynamic) by claiming each technique separately. By merely comparing claims 11 and 12 in Verhaverbeke, the skilled artisan would readily ascertain that static and dynamic modes are equally significant in the recited etching process -- and therefore interchangeable.

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[3] Verhaverbeke indicates that "[i]n the static mode, the reactor is filled with a process gas up to a certain pressure and then the reactor is isolated for some time. Subsequently, the reactor is evacuated and the etch cycle can be repeated for a number of times. In the dynamic mode, a continuous flow of process gas is fed into the reactor which is maintained at a constant pressure" (Verhaverbeke, col. 3, ll. 22-28).

This teaching, in our view, would reasonably suggest to the skilled artisan that a dynamic mode could be utilized in lieu of the pulse mode of Mehta. Although Appellants argue that the skilled artisan would not equate Mehta's pulse mode with Verhaverbeke's static mode (Br. 7), we find this argument unavailing. Verhaverbeke's static mode (1) fills the reactor with process gas at a certain pressure, (2) isolates the reactor for a certain time period (e.g., 200 seconds), and (3) evacuates the reactor (Verhaverbeke, col. 3, ll. 22-25; col. 6, ll. 14-30). Mehta's pulse mode (1) adds anhydrous HF gas to an anhydrous inert gaseous environment in pulses with 3-8 second duration (and perhaps even longer),[4] (2) flushes the environment with anhydrous inert gas, and (3) repeats steps (1) and (2), as appropriate, for oxide layer removal (Mehta, col. 2, ll. 7-25; col. 3, ll. 3-44; col. 4, ll. 23-46; Abstract).

Although both Mehta's pulse mode and Verhaverbeke's static mode utilize somewhat different procedures, they nonetheless share a fundamental characteristic: they both apply process gas to the substrate *intermittently or cyclically*.[5] Based on this fundamental common attribute, the skilled artisan would have readily associated the pulse and static modes of Mehta and Verhaverbeke respectively, at least with respect to a dynamic mode (i.e., an unbroken, continuous application of process gas for a relatively longer duration).

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[4] *See* P. 6, *supra*, of this opinion.

[5] Since our finding is based solely on the disclosures of Mehta and Verhaverbeke, we need not further discuss the Westendorp reference (US 5,167,761) that Verhaverbeke refers to in passing in connection with the static mode. *See* Verhaverbeke, col. 2, l. 10; *see also* Answer 7-8; Reply Br. 1-2.

Furthermore, the fact that Verhaverbeke uses carboxylic acid (unlike Mehta) does not otherwise detract from Verhaverbeke's fundamental teaching (i.e., that the static and dynamic modes are interchangeable). That is, the skilled artisan would readily understand that substrates can be etched by applying process gas in either an intermittent or a continuous fashion for a relatively longer duration (i.e., a static or dynamic mode). In short, we see no reason why the skilled artisan would not apply this fundamental teaching to the system of Mehta. In our view, applying process gas to a substrate in a continuous, unbroken fashion in lieu of pulsing such gas would be readily applicable to Mehta's system irrespective of the absence of carboxylic acid or water. Moreover, Mehta's silence regarding utilizing a continuous, unbroken application of process gas (i.e., a dynamic mode) -- even despite its relative simplicity and concomitant advantages as compared to a pulsed technique as noted by Appellants[6] -- simply does not preclude its application in Mehta's system.

For the foregoing reasons, Appellants have not persuasively rebutted the Examiner's prima facie case of obviousness of independent claim 1. Accordingly, we will sustain the Examiner's rejection of that claim.

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[6] *See* Br. 6; *see also* Specification 45:20-22 (noting the favorable results achieved with Appellants' Example 1 which feeds anhydrous HF and heated nitrogen gas into a treatment chamber (*see* Specification page 28, line 8, *et seq*.) as compared to the pulsed treatment of Comparative Example 3 which alternately introduces HF gas and nitrogen into a chamber (*see* Specification page 41, line 22, *et seq*.)).

The Dependent Claims

Although Appellants nominally argue the rejection of dependent claims 2, 3, and 5-14 separately (Br. 7-9), the arguments presented merely allege that the combination of Mehta and Verhaverbeke does not disclose the limitations recited in the respective dependent claims. Apart from these mere conclusory statements, Appellants provide no supporting analysis or explanation as to why the cited prior art fails to disclose the recited limitations. Merely pointing out what a claim recites is not considered an argument for separate patentability of the claim. 37 C.F.R. § 41.37(c)(1)(vii). In any event, Appellants have not persuasively rebutted the Examiner's prima facie case of obviousness based on the collective teachings of the references indicated on pages 4-6 of the Answer. The Examiner's rejection of these claims is therefore sustained.

DECISION

We have sustained the Examiner's rejection with respect to all claims on appeal. Therefore, the Examiner's decision rejecting claims 1-3 and 5-14 is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

KIS

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