

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

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte MASAHIRO KAWASAKI

Appeal 2007-0442
Application 10/470,060
Technology Center 1700

Decided: May 30, 2007

Before CHUNG K. PAK, THOMAS A. WALTZ, and JEFFREY T. SMITH,
Administrative Patent Judges.

PAK, *Administrative Patent Judge.*

DECISION ON APPEAL

This is an appeal from the Examiner's final rejection of claims 3, 5, 6, and 7, all of the claims pending in the above-identified application. We have jurisdiction pursuant to 35 U.S.C. §§ 6 and 134.

The subject matter on appeal is directed to “a method of forming a thick silicon dioxide film on a silicon substrate” (Specification 1). The method “comprises repeating steps of depositing a silicon layer on a silicon substrate and then, subjecting the silicon layer to a thermal oxidation treatment to form a silicon dioxide film of a predetermined thickness....” (Specification 3). This method is said to overcome the problems associated with a typical thick silicon dioxide film forming method (Specification 1-2). Details of the appealed subject matter are recited in representative claim 3 reproduced below:

3. A method of forming a silicon dioxide film of a predetermined thickness on a silicon substrate, comprising:

a deposition step of depositing epitaxial silicon on said silicon substrate or on a silicon dioxide film formed on said silicon substrate by a thermal oxidation treatment to obtain a deposited epitaxial silicon film; and

a thermal oxidation step of oxidizing said deposited epitaxial silicon film by heat to convert it into a silicon dioxide film,

wherein said deposition step and said thermal oxidation step are repeated a plural number of times.

As evidence of unpatentability of the claimed subject matter, the Examiner has relied upon the following references:

Jacobson	US 3,807,039	Apr. 30, 1974
Faraone	US 4,604,304	Aug. 5, 1986
Corboy, Jr.	US 4,698,316	Oct. 6, 1987
Arai	US 2001/0001384 A1	May 24, 2001
Sato	US 6,375,738 B1	Apr. 23, 2002

The Examiner has rejected the claims on appeal as follows:

- 1) Claims 3 and 5 under 35 U.S.C. § 103(a) as unpatentable over the combined teachings of Faraone and Jacobson; and
- 2) Claims 6 and 7 under 35 U.S.C. § 103(a) as unpatentable over the combined teachings of Faraone, Jacobson, Corboy, Jr., Sato, and Arai.

In support of his rejection of the claims on appeal¹, the Examiner has found (Answer 3-4) that Faraone, like the Appellant, broadly teaches:

[A] process of producing thick layers of silicon dioxide on a silicon substrate by initially oxidizing the substrate to form a thin layer of silicon dioxide thereon, subsequently depositing a thin layer of silicon and oxidizing this thin silicon layer to increase the size of the silicon dioxide layer (Summary of Invention). To form a desired thickness of silicon dioxide the deposition steps and oxidation steps are repeated as necessary (Claim 1, column 4; Summary of Invention, column 2). Faraone discloses the thickness of silicon per one deposition between 120 and 400 nanometers (Column 3, lines 6-8).

Recognizing that Faraone does not specifically mention the claimed epitaxial silicon layer, the Examiner has relied on Jacobson to explain that Falaone's silicon layer includes the claimed epitaxial silicon layer (Answer 4). Specifically, the Examiner has found that consistent with Faraone's disclosure above, Jacobson teaches that deposition and thermal oxidation of a thin epitaxial silicon layer on a silicon substrate is useful for forming an insulating silicon dioxide coating (*id*).

¹ According to the Appellant (Br. 5), “claims 3, 5, 6, and 7 stand or fall together.”

Relying on the above teachings, the Examiner has determined that one of ordinary skill in the art would have been led to deposit and thermally oxidize thin silicon layers, including epitaxial silicon layers, in Faraone's method, with a reasonable expectation of successfully forming an insulating silicon dioxide film having a desired thickness (*id*). According to the Examiner (*id*):

Faraone teaches thermally oxidizing a silicon [layer inclusive of the epitaxial silicon taught by Jacobson] to provide a[n] insulating silicon dioxide film and Jacobson teaches that it is known in the art that a known method of producing a silicon dioxide film is thermally oxidizing an epitaxial silicon layer.

The Appellant contends that Faraone and Jacobson do not provide any suggestion to employ the epitaxial silicon layer in Faraone's method (Br. 8-11). The Appellant also indicates that "the use of epitaxial silicon yields several advantages as demonstrated in Figure 2 of Appellant's invention" (Br. 7).

The dispositive question is whether one of ordinary skill in the art would have been led to deposit and thermally oxidize thin silicon layers, such as thin epitaxial silicon layers, in the process of Faraone, with a reasonable expectation of successfully obtaining an insulating silicon dioxide layer or film having a desired thickness within the meaning of 35 U.S.C. § 103. On this record, we answer this question in the affirmative.

Although Faraone exemplifies depositing and thermally oxidizing amorphous silicon layers on a substrate as argued by the Appellant, it clearly is not limited to such an embodiment. *See also In re Boe*, 355 F.2d 961, 965, 148 USPQ 507, 510 (CCPA 1966) (all of the disclosures in a reference,

including non-preferred embodiments, “must be evaluated for what they fairly teach one of ordinary skill in the art”); *Merck & Biocraft Labs., Inc.*, 874 F.2d 804, 807, 10 USPQ2d 1843, 1846 (Fed. Cir. 1989)(“the fact that a specific [embodiment] is taught to be preferred is not controlling, since all disclosures of the prior art, including unpreferred embodiments, must be considered”). As indicated *supra*, Faraone teaches employing any thin layer of silicon susceptible to forming a silicon dioxide layer via thermal oxidation. Faraone as a whole, like the Appellant, focuses on repeating deposition and thermal oxidation of thin silicon layers to incrementally form a desired thick silicon dioxide film to avoid any disadvantages associated with conventional thick silicon dioxide film forming processes (Faraone, Abstract and col. 1 to col. 4). Jacobson explains that, *inter alia*, thin epitaxial silicon layers, like other deposited silicon layers, are well known to be capable of being converted to silicon dioxide films upon being subjected to thermal oxidation.

Thus, given the recognized need to form a thick silicon dioxide film on a substrate (Faraone, col. 1, ll.9-20), we concur with the Examiner that one of ordinary skill in the art would have been led to deposit and thermally oxidize thin silicon layers, such as amorphous and epitaxial silicon layers, in Faraone’s thick silicon dioxide film forming process, with a reasonable expectation of successfully forming a desired thick silicon dioxide film. *See also KSR Int’l Co. v. Teleflex, Inc.*, 127 S. Ct. 1727, 1739, 82 USPQ2d 1385, 1395 (2007)(“The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.”); *In re Hoeschele*, 406 F.2d 1403, 1406-07, 160 USPQ 809, 811-

812 (CCPA 1969) (“[I]t is proper to take into account not only specific teachings of the references but also the inferences which one skilled in the art would reasonably be expected to draw therefrom...”).

The Appellant asserts that “the use of epitaxial silicon yields several advantages as demonstrated in Figure 2 of Appellant’s invention” (Br. 7). However, the Appellant does not aver, much less argue, that these advantages are unexpected. *In re Klosak*, 455 F.2d 1077, 1080, 173 USPQ 14, 16 (CCPA 1972) (the difference in the results obtained by the claimed subject matter and the prior art must be shown to be unexpected); *In re Geisler*, 116 F.3d 1465, 1469-70, 43 USPQ2d 1362, 1365 (Fed. Cir. 1997)(party asserting unexpected results has the burden of proving that the results are unexpected). Nor does the Appellant explain why the showing relied upon is reasonably commensurate in scope with the breadth of the claimed invention. *In re Harris*, 409 F.3d 1339, 1344, 74 USPQ2d 1951, 1955 (Fed. Cir. 2005); *In re Greenfield*, 571 F.2d 1185, 1189, 197 USPQ 227, 230 (CCPA 1978). The Appellant simply fails to prove that the claimed invention imparts unexpected results, thereby failing to rebut any inference of obviousness established by the Examiner. See, e.g., *In re Heyna*, 360 F.2d 222, 228, 149 USPQ 692, 697 (CCPA 1966)(applicant required to submit clear and convincing evidence to support an allegation of unexpected property).

As to the § 103 rejection of claims 6 and 7, the Appellant only argues that none of Corboy Jr., Sato, and Aria remedies the above-argued deficiencies in Faraone and Jacobson. Thus, for the same reasons set forth above, we determine that the Appellants’ argument is not convincing.

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In view of the forgoing, we determine that the prior art relied upon by the Examiner would have rendered the claimed subject matter obvious to one of ordinary skill in the art within the meaning of 35 U.S.C. § 103. Accordingly, the decision of the Examiner 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).

AFFIRMED

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