

THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

The opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

Paper No. 25

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte TINGHAO WANG, UAHA RAGHURAM
and JAMES E. NULTY

Appeal No. 2003-2001
Application No. 09/345,173

ON BRIEF

Before GARRIS, PAK and KRATZ, Administrative Patent Judges.
KRATZ, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal from the examiner's final rejection of claims 1-16 and 19-22, which are all of the claims pending in this application.

BACKGROUND

Appellants' invention relates to a polysilicon layer etching method. An understanding of the invention can be derived from a reading of exemplary claim 1, which is reproduced below.

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1. A method comprising etching a poly-silicon layer during fabrication of an integrated circuit following a first hydrofluoric acid (HF) dip to remove surface oxides from the poly-silicon layer, an anisotropic descumming operation to remove resist material left over from a patterning operation on the poly-silicon layer and a long anisotropic breakthrough etch.

In addition to alleged admitted prior art, the references of record relied upon by the examiner in rejecting the appealed claims are:

Chen	5,308,400	May 03, 1994
Cher et al. (Cher)	5,453,156	Sep. 26, 1995
Vogel et al. (Vogel)	5,631,178	May 20, 1997
Chung et al. (Chung)	5,930,650	Jul. 27, 1999 (filed Aug. 01, 1997)

Claims 1-11 and 13-16 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Chung in view of Cher. Claims 2-5 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Chung in view of Cher and Chen. Claims 8, 13-16, 19, 20 and 22 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Chung in view of Cher and alleged admitted prior art in appellants' specification. Claims 12 and 21 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Chung in view of Cher and Vogel.

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

OPINION

Upon careful review of the respective positions advanced by appellants and the examiner with respect to the rejection that is before us for review, we find ourselves in agreement with appellants' viewpoint in that the examiner has failed to carry the burden of establishing a prima facie case of obviousness. See In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992); In re Piasecki, 745 F.2d 1468, 1471-1472, 223 USPQ 785, 787-788 (Fed. Cir. 1984). Accordingly, we will not sustain the examiner's rejections.

Independent claim 1 and the claims depending therefrom require a hydrofluoric acid (HF) dip of a polysilicon layer to remove surface oxides, an anisotropic descumming operation to remove leftover resist material from a patterning operation on the polysilicon layer, and a long anisotropic breakthrough etch. Those steps are followed by etching the polysilicon layer during the fabrication of an integrated circuit.

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Chung (abstract and column 2, lines 43 and 44) is directed to etching silicon materials and, in one embodiment, teaches using an HF bath to remove thin oxide from a poly silicon surface in an early stage of a silicon metal-oxide semiconductor (MOS) device fabrication method that uses a PBL process (column 2, lines 43 and 44 . Chung explains in the background section of the patent (column 1, lines 28-41) that:

The PBL process is used at an early stage of silicon device fabrication to form silicon oxide regions which can act as isolation oxide. Briefly, the PBL process proceeds as follows. After a thin oxide layer is formed over a silicon substrate, a polysilicon layer is deposited, followed by a silicon nitride layer. The combined nitride and polysilicon layers, sometimes referred to as a nitride/poly stack, are then patterned using photolithography and etching techniques which are well known in the semiconductor industry. With the patterned nitride/poly stack acting as a mask, oxidation is performed to produce field oxide regions over the silicon substrate. This nitride/poly stack generally needs to be removed prior to subsequent processing.

Subsequent to the HF bath dip, silicon nitride material is deposited over the polysilicon layer and the nitride and polysilicon layers (the nitride/poly stack) are taught as being patterned using known lithographic and etching methods. The nitride/poly stack of Chung is used as a mask during an oxidation

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step to form field oxide regions (thicker silicon oxide regions). Chung employs a wet etching step (hot phosphoric acid bath) to remove the remaining nitride/poly stack while maintaining the thickness and integrity of field oxide regions and a pad oxide region. See column 2, line 46 through column 3, line 23 of Chung.

The examiner acknowledges (answer, page 3) that Chung does not describe using a breakthrough etch step or a descumming step as required by appellants' claims.

The examiner turns to Cher for allegedly teaching and suggesting the claimed breakthrough etch step. In this regard, the examiner (answer, page 3) takes the position that:

Cher teaches [a] method for anisotropically etching the polysilicon having a first breakthrough etch using a fluorocarbon etchant (col. 4, line[s] 30-35). It would have been obvious at the time of the invention for one skill[ed] in the art to modify Chung in light of Cher because Cher teaches that the breakthrough etch would remove the oxide on the poly before the main etch.

The examiner (answer, page 6) further explains that:

[a]s described by Chung, the HF dip is done before forming and etching the nitride layer and the breakthrough etch, described by Cher, is done right before the actual etching of the polysilicon is carried out.

As for the claimed descumming step, the examiner asserts, at pages 3 and 4 of the answer, that:

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Unlike [the] claimed invention, [the] above prior art doesn't describe a step of descumming. The lithography that is well known to one skilled in the art includ[es] applying resist as a pattern for etching layers. Cher shows the use of resist as a pattern for etching (col. 2, line[s] 5-8). Because a photoresist is used, descumming anistropically or isotropically is well known to and generally available to one skill[ed] in the [art] as a part of developing the photoresist in order to remove all the small resist that is left from the development step to provide a quality pattern. (Please see Wolf and Savas et al. cited below).

Aside from the improper reference to Wolf and Savas et al. in the answer¹ for allegedly establishing the obviousness of the claimed anisotropic descumming step, we cannot agree that the examiner's proposed modification of Chung based on the teachings of Cher has been fairly established as being obvious within the meaning of 35 U.S.C. § 103(a), on this record.

As noted by appellants in the brief (page 6), the examiner has not established that Chung's process would have required a breakthrough etch step for removing native oxide on the

¹ We do not consider Wolf and Savas et al. as being properly before us in our consideration of the examiner's rejections. This is so since the examiner's statement of the first rejection (first sentence of numbered subitem 2 of item No. 10 of the answer), like the statements of the other rejections before us, do not list Wolf and Savas et al. as part of the evidence being relied upon to establish obviousness. Also, see the Prior Art of Record section of the answer, which is in accord in not listing those references as evidence being relied upon. See In re Hoch, 428 F.2d 1341, 1342 n.3, 166 USPQ 406, 407 n.3 (CCPA 1970). We also note that appellants do not recognize those references as being applied by the examiner in their brief.

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polysilicon, the basis for the combination asserted by the examiner. As taught by Cher, the breakthrough etch is one of four etching steps used in Cher's dry etching process that allegedly avoids undercutting and foot formation problems in forming a polysilicon gate. The examiner has not referred us to any disclosure in Chung that suggests the HF dip thereof does not adequately remove the thin oxide from the polysilicon surface for facilitating subsequent wet etching therein in their disclosed field oxide regions and pad oxide region formation process.

While Cher (column 5, line 63 through column 6, line 1) refers to an HF dip for removing sidewall deposits after the four step etching procedure and resist stripping, the examiner has not fairly explained how that disclosed HF dip step, occurring after the four step etching operation and subsequent resist stripping of Cher, would have suggested the proposed modification of Chung's process.

Nor has the examiner convincingly explained how Chen, the alleged admitted prior art, and/or Vogel, as additionally applied in the other rejections for allegedly rendering obvious other features associated with the separately rejected claims, would have suggested modifying Chung's method to include the descumming and breakthrough etch steps. Concerning appealed independent claim 19 and the claims depending thereon, we note that, like

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independent claim 1, appealed claim 19 requires an HF dip, descumming and a breakthrough etch, albeit with a substrate having a second polysilicon layer thereon. For the reasons discussed above, the examiner has not met the burden of furnishing a reasonable evidentiary basis and analysis based thereon that explains why one of ordinary skill in the art would have been led to modify the process of Chung to include all of the steps as required by appealed claim 19.

It follows that we will not sustain any of the examiner's rejections on this record.

CONCLUSION

The decision of the examiner to reject claims 1-11 and 13-16 under 35 U.S.C. § 103(a) as being unpatentable over Chung in view of Cher; to reject claims 2-5 under 35 U.S.C. § 103(a) as being unpatentable over Chung in view of Cher and Chen; to reject claims 8, 13-16, 19, 20 and 22 under U.S.C. § 103(a) as being unpatentable over Chung in view of Cher and alleged admitted prior art in appellants' specification; and to reject claims 12 and 21 under 35 U.S.C. § 103(a) as being unpatentable over Chung in view of Cher and Vogel is reversed.

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REVERSED

BRADLEY R. GARRIS)	
Administrative Patent Judge)	
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)	BOARD OF PATENT
CHUNG K. PAK)	APPEALS
Administrative Patent Judge)	AND
)	INTERFERENCES
)	
)	
PETER F. KRATZ)	
Administrative Patent Judge)	

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