

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 KAREN T. SIGNORINI

Appeal 2007-1097
Application 10/230,593
Technology 2800

Decided: September 21, 2007

Before ADRIENE LEPIANE HANLON, RICHARD TORCZON, and MICHAEL P. TIERNEY, *Administrative Patent Judges*.

HANLON, *Administrative Patent Judge*.

DECISION ON APPEAL

1 A. STATEMENT OF CASE

2 The Appellant seeks review under 35 U.S.C. § 134 of a final rejection
3 of claims 1, 8-11, and 18-28, all of the claims pending in the application.

4 We have jurisdiction under 35 U.S.C. § 6(b).

5 The application on appeal was filed on August 29, 2002.

6 The real party in interest is Micron Technology, Inc.

1 The Examiner rejected all of the claims under 35 U.S.C. § 102(b) as
2 being anticipated by Gupta et al.

3 U.S. Patent 5,910,453 issued to Gupta et al. on June 8, 1999
4 (hereinafter “Gupta”).

5 Gupta is prior art under 35 U.S.C. § 102(b).

6 B. ISSUE

7 The issue is whether the Appellant has sustained its burden of
8 showing that the Examiner erred in rejecting claims 1, 8-11, and 18-28 under
9 35 U.S.C. § 102(b) as being anticipated by Gupta.

10 C. FINDINGS OF FACT

11 The following findings of fact are believed to be supported by a
12 preponderance of the evidence. Additional findings of fact as necessary
13 appear in the Analysis portion of the opinion.

14 1. Background of the invention

15 Integrated circuits are typically fabricated on a wafer surface through
16 any number of manufacturing processes, such as layering, doping, and
17 patterning. Specification 4:1-2.

18 One commonly used patterning technique is photolithography. In
19 implementing photolithography techniques, a pattern may be formed using a
20 photomask to expose certain regions of a radiation sensitive material, such
21 as a photoresist or resist, to a certain wavelength of light. Specification
22 4:20-5:1.

23 An anti-reflectant coating (ARC) layer, such as a bottom anti-
24 reflectant coating (BARC) layer may be implemented underneath the resist
25 to enhance the photolithography process. The BARC layer is used to absorb
26 the radiation generated by the energy source. By providing a layer for

1 absorbing the radiation, the patterned structure is typically more defined
2 with fewer defects than the methods wherein a BARC layer is not included.
3 Specification 5:9-14.

4 Once the resist has been patterned, the resist layer may be removed to
5 allow the underlying structure to be developed. While it may be desirable to
6 retain the BARC layer, it is typically desirable to remove the BARC layer
7 through an etching process. Specification 5:14-16.

8 To etch the BARC layer, a dry etch plasma including fluorine or
9 nitrogen compounds or O₂ is typically implemented. Specification 6:11-12.

10 According to the Appellant, these etchants present certain problems
11 relating to the selectivity of the underlying materials. Specification 6:12-21.

12 2. Appellant's invention

13 The Appellant's invention generally relates to a method of
14 manufacturing integrated circuits and, more particularly, to a method of
15 etching anti-reflectant coating layers. Specification 2:7-8.

16 Figure 1 is a cross sectional view of a device **10**, such as an integrated
17 circuit, during the fabrication process. Specification 8:6-7.

18 An anti-reflectant (ARC) layer, such as a bottom anti-reflectant
19 coating (BARC) layer **14** and a photoresist **16** are disposed over a substrate
20 **12**. Specification 8:7-9.

21 The substrate **12** may be a semiconductor wafer, photomask blank,
22 dielectric foundation, etc. Specification 8:9-10.

23 One specific method used to etch the BARC **14** may be a dry etch
24 plasma process. Specification 10:19.

1 According to the Appellant's specification, the dry plasma etchant is a
2 CO₂ compound either alone or in combination with at least one other gas,
3 such as NH₃, H₂, Ar, N₂, He, or inert gases. Specification 11:1-4.

4 The Appellant discloses that the CO₂ etchant has several advantages,
5 including greater control of the etch rate and greater selectivity.
6 Specification 11:6-19.

7 2. Claims on appeal

8 The Application contains four independent claims, claims 1, 11,
9 20, and 23. Claim 1 is representative of the subject matter on appeal:

10 A method for patterning an organic bottom anti-reflectant
11 coating layer over a semiconductor substrate, the method
12 comprising the act of:

13 using a dry etch plasma process, the dry etch plasma
14 process consisting of CO₂ in combination with only one of an
15 inert gas, NH₃, H₂, Ar, N₂ or He to pattern the organic bottom
16 anti-reflectant coating layer.

17 3. Gupta

19 The invention disclosed in Gupta enables the removal of an organic
20 ARC layer which is exposed after patterning a photoresist layer. Gupta
21 4:34-37.

22 A magnetically-enhanced reactive ion etch (MERIE) system is
23 employed to remove the ARC layer. Gupta 7:5-7.

24 A plasma etchant is introduced into the MERIE system to etch the
25 layer of ARC. Gupta 7:16-18.

26 The plasma etchant includes an oxygen plasma. Gupta 7:18-19.

27 An "oxygen plasma" means a plasma comprising oxygen species,
28 such as O₂⁺ and O⁺, derived from a source of oxygen, such as O₂, NO, N₂O,
29 NO₂, CO, and CO₂. Gupta 7:21-24.

1 Gupta indicates that the source of the oxygen plasma is preferably
2 molecular oxygen, O₂, and reference to “O₂ plasma” is directed to this
3 embodiment. Gupta 7:24-27.

4 Nevertheless, Gupta discloses that alternative sources of oxygen such
5 as CO₂, NO, and N₂O may be suitably employed as a source of oxygen
6 plasma in the process of the present invention. Gupta 9:17-21.

7 To minimize the effect of atomic oxygen near the reaction site,
8 scavenger atoms are provided in the Gupta process. The scavenger atoms
9 comprise free radicals which are capable of sweeping and/or capturing
10 atomic oxygen. Gupta 7:50-54.

11 Preferably, the scavenger atoms are provided by including a nitrogen
12 plasma in the plasma etchant. Preferably, the nitrogen plasma is provided by
13 N₂. Gupta 7:64-67.

14 Additionally, a significant amount of helium is added to the mixture
15 of nitrogen and oxygen. Gupta 8:12-13.

16 Helium is said to minimize thermal degradation of the photoresist
17 layer. Gupta 8:14-17.

18 Without helium or other inert gases, melting of the photoresist layer is
19 said to be a concern, and in some cases, the etching process must be
20 periodically stopped to allow for cooling. Gupta 8:17-19.

21 In Example 2, a mixture of oxygen and nitrogen **without** helium is
22 said to have provided an increased etch rate. Gupta 11:26-47.

23 Adding helium in Example 2 is said to have reduced the residence
24 time of active oxygen species. Gupta 11:48-53.

1 D. PRINCIPLES OF LAW

2 The USPTO applies to the verbiage of a claim “the broadest
3 reasonable meaning of the words in their ordinary usage as they would be
4 understood by one of ordinary skill in the art, taking into account whatever
5 enlightenment by way of definitions or otherwise that may be afforded by
6 the written description contained in the applicant’s specification.” *In re*
7 *Morris*, 127 F.3d 1048, 1054, 44 USPQ2d 1023, 1027 (Fed. Cir. 1997).

8 “A claim is anticipated only if each and every element as set forth in
9 the claim is found, either expressly or inherently described, in a single prior
10 art reference.” *Verdegaal Bros., Inc. v. Union Oil Co.*, 814 F.2d 628, 631,
11 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

12 Where the claimed and prior art products are identical or substantially
13 identical, or are produced by identical or substantially identical processes,
14 the USPTO can require an applicant to prove that the prior art products do
15 not necessarily or inherently possess the characteristics of his invention. *In*
16 *re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977).

17 “A reference is no less anticipatory if, after disclosing the invention,
18 the reference then disparages it.” *Celeritas Tech. Ltd. v. Rockwell Int’l*
19 *Corp.*, 150 F.3d 1354, 1361, 47 USPQ2d 1516, 1522 (Fed. Cir. 1998).

20 E. ANALYSIS

21 1. Claim construction

22 Claim 1 recites a method for patterning an organic bottom anti-
23 reflectant coating layer comprising the act of “using a dry etch plasma
24 process, the dry etch plasma process consisting of CO₂ in combination with
25 only one of an inert gas, NH₃, H₂, Ar, N₂ or He.” The phrase “consisting of”
26 does not define a compound but rather defines a step in the claimed method,

1 i.e., using CO₂ in combination with only one of an inert gas, NH₃, H₂, Ar, N₂
2 or He in some capacity.

3 According to the Appellant's Specification, CO₂ is used either alone
4 or in combination with other gases, such as NH₃, H₂, Ar, N₂, He, or inert
5 gases, as the dry plasma etchant. Specification 11:1-4. Thus, giving claim 1
6 the broadest reasonable interpretation consistent with the Appellant's
7 specification, it is reasonable to interpret claim 1 as reciting that CO₂ and
8 only one of an inert gas, NH₃, H₂, Ar, N₂ or He are used to generate the dry
9 plasma etchant in the claimed method. *See Morris*, 127 F.3d at 1054, 44
10 USPQ2d at 1027 ("it would be unreasonable for the PTO to ignore any
11 interpretive guidance afforded by the applicant's written description").

12 2. Claims 1, 11, 20, and 23-26

13 The Examiner finds that Gupta uses a dry plasma etch process to
14 pattern an organic bottom anti-reflectant coating layer. The Examiner finds
15 that Gupta uses an oxygen containing gas, such as CO₂, in combination with
16 a nitrogen containing gas, such as N₂, and helium in the disclosed process.
17 Relying on column 8, lines 12-19 of Gupta, the Examiner finds that Gupta
18 discloses a non-preferred embodiment wherein only an oxygen source and a
19 nitrogen source are used. Final Office Action mailed January 20, 2006 at 2-
20 3; Answer at 3-4, 5-6.

21 The portion of Gupta relied on by the Examiner reads as follows
22 (Gupta 8:12-19):

23 Additionally, a significant amount of He is added to the
24 mixture of nitrogen and oxygen. Helium is an effective heat
25 conductor and thus helps in cooling the wafer surface. By
26 provid[ing] adequate cooling of the wafer surface, helium
27 minimizes thermal degradation of the layer of photoresist 10.
28 **Without helium** or other inert gases, melting of the layer of

1 photoresist 10 is a concern, and in some cases, the etching
2 process must be periodically stopped to allow for cooling.
3 [Emphasis added.]
4

5 The Appellant argues that the final sentence of the passage reproduced
6 above is not an embodiment of the Gupta invention. However, the
7 Appellant argues that even if the final sentence can be considered an
8 embodiment of the Gupta invention, Gupta, at best, teaches etching via a N₂
9 and O₂ mixture. See Gupta 7:24-27. The Appellant argues that Gupta does
10 not disclose an embodiment using a mixture consisting of CO₂ and only one
11 other gas. Appeal Brief at 10.

12 To the extent that Gupta discloses that etching without helium is less
13 than optimal, we find that Gupta nonetheless discloses that oxygen and
14 nitrogen may be used alone in the disclosed etching process. Indeed, we
15 find that Example 2 illustrates a dry plasma etch process for patterning an
16 ARC layer wherein “A mixture of oxygen and nitrogen, without helium
17 provided an increased etch rate.” Gupta 11:26-47.

18 The disclosure of Gupta focuses on molecular oxygen, O₂, as the
19 source of oxygen plasma. Nevertheless, Gupta expressly discloses that
20 alternative sources of oxygen plasma include CO₂. Gupta 7:21-24 and 9:17-
21 18.

22 For the reasons set forth above, it is reasonable to find that Gupta
23 anticipates the method of claim 1.

24 The Appellant does not argue the patentability of claims 11, 20, and
25 23-26 separately. Therefore, claims 11, 20, and 23-26 stand with claim 1.

3. Claims 8-10, 18, 19, 21, 22, 27, and 28

1 Claims 8-10 depend from claim 1. The Examiner finds that the
2 subject matter of claims 8-10 is inherently disclosed in Gupta because Gupta
3 treats the same materials in the same manner as the Appellant. Final Office
4 Action dated January 20, 2006 at 3-4; Answer at 4-5.

5 With respect to claim 1, the Appellant argues that Gupta does not
6 teach the same materials and instead teaches other mixtures, such as a N₂-
7 O₂-He mixture. On this basis alone, the Appellant argues that the
8 Examiner's basis for inherency is untenable. Appeal Brief at 11.

9 As discussed above, Gupta clearly describes an etching process using
10 the same materials recited in claim 1. Therefore, it is reasonable to find that
11 the subject matter of claims 8-10 is inherently disclosed in Gupta.

12 The Appellant does not argue the patentability of claims 18, 19, 21,
13 22, 27, and 28 separately. Therefore, claims 18, 19, 21, 22, 27, and 28 stand
14 with claims 8-10.

15 F. CONCLUSIONS OF LAW

16 The Appellant has not sustained its burden of showing that the
17 Examiner erred in rejecting claims 1, 8-11, and 18-28 under 35 U.S.C.
18 § 102(b) as being anticipated by Gupta.

19 G. DECISION

20 The rejection of claims 1, 8-11, and 18-28 under 35 U.S.C. § 102(b)
21 as being anticipated by Gupta is AFFIRMED.

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

AFFIRMED

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