

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte FRANCIS G. CELII,
MAHESH THAKRE,
SCOTT R. SUMMERFELT,
and THEODORE S. MOISE

Appeal 2008-3203
Application 10/426,502
Technology Center 1700

Decided: June 3, 2008

Before EDWARD C. KIMLIN, BRADLEY R. GARRIS, and
ROMULO H. DELMENDO, *Administrative Patent Judges*.

KIMLIN, *Administrative Patent Judge*.

DECISION ON APPEAL

This is an appeal from the final rejection of claims 1-38. Claim 1 is illustrative:

1. A method of cleaning, by etching a material stack having a hardmask top layer, the improvement consisting of:

using a BCl₃-based etchant for said cleaning by said etching said material stack and said hardmask top layer;

wherein said cleaning step follows a patterning step to create said material stack, and wherein said hardmask is a template for said prior patterning step.

The Examiner relies upon the following references as evidence of obviousness:

Ying	6,436,838 B1	Aug. 20, 2002
Egger	2004/0150923 A1	Aug. 5, 2004

Appellants' claimed invention is directed to a method of cleaning a material stack having a hardmask top layer. The hardmask is cleaned by etching. The asserted improvement for cleaning/etching the hardmask is using a BCl₃-based etchant and performing the cleaning following a patterning step which creates the material stack.

Appealed claims 1-3, 5, 7, 9, 11-17, 28-31, and 33 stand rejected under 35 U.S.C. § 102(a) as being anticipated by Ying. Claims 4, 6, 8, 10, 18-27, 32, and 34-38 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Ying in view of Egger.

We have thoroughly reviewed each of Appellants' arguments for patentability. However, we find that the Examiner's rejections are well-founded and supported by the cited prior art. Accordingly, we will sustain the Examiner's rejections for essentially those reasons expressed in the Answer and we add the following primarily for emphasis.

We consider first the Examiner's § 102 rejection over Ying. There is not dispute that Ying, like Appellants, discloses the etching of a material

stack having a hardmask top layer comprising TiN by using an etchant such as BCl_3 , Ar/BCl_3 and Cl_2/BCl_3 .

A principal contention of Appellants is that Ying does not describe cleaning by etching which follows a patterning step to create a material stack. However, we agree with the Examiner that cleaning by etching of the hardmask necessarily occurs near the end of Ying's patterning by etching which creates the material stack. Appellants' Specification states that the cleaning by etching step smoothes and removes an oxide film on the hardmask and, absent evidence to the contrary, it is reasonable to conclude that at least some such cleaning occurs at the latter stages of Ying's patterning/etching step.

Furthermore, as pointed out by the Examiner, Ying discloses an over-etching step subsequent to patterning that cleans off residual PZT. Since Ying's overetching step uses the same etchant as Appellants, namely, BCl_3 , we agree with the Examiner that Ying's hardmask is also cleaned during the overetching step (see para. bridging cols. 5-6).

In addition, Ying expressly discloses that "[t]ypically residual TiN masking material may be removed using the plasma etch process described with reference to pattern etching of TiN" (col. 7, ll. 11-13). Hence, Appellants' claimed step of cleaning by etching the hardmask with a BCl_3 -based etchant reads on Ying's removal of the TiN masking material. The appealed claims are sufficiently broad to embrace a cleaning step which removes the hardmask.

Appellants submit that Ying "teaches that the patterning of the material stack or the capacitor continues after the etch of the PZT layer" (Br. 18, second para.). However, Ying's Example TWO uses the patterned TiN

masking layer to transfer the pattern through only a portion of the capacitor structure down to interlayer 306 of PZT dielectric.

Appellants also maintain that "one skilled in the art does not consider an etch used during a patterning process to be interchangeable with an etch used during a cleaning process" (*id.*). However, as noted above, Ying specifically teaches that the overetch cleaning step uses the same BCl₃ etchant as the patterning step, as does the etchant step for removing the residual hardmask.

Appellants also maintain that Ying does not teach the use of an Cl₂/BCl₃-based etchant to clean by etching a material stack. However, as noted by the Examiner, Ying teaches that Cl₂ may be added to the etchant to improve selectivity (col. 7, ll. 52 et seq.).

Appellants further submit that Ying "does not teach cleaning a completed material stack with the same etchant that was used for patterning the PZT layer of the material stack" (Br. 22, second para.). However, as explained above, Ying specifically discloses that the overetch cleaning step uses a BCl₃ plasma, which is the same plasma used for patterning.

Concerning separately argued claim 13, Appellants maintain that Ying does not teach patterning of a gate. However, Appellants have not refuted the Examiner's finding that "gates are inherent in integrated circuits" of the type described by Ying (Ans. 6, penultimate para.).

As for the claim 28 recitation of smoothing a surface of a hardmask by etching the surface with a BCl₃-based plasma etchant after patterning, we concur with the Examiner that smoothing necessarily occurs during Ying's later stages of patterning, during the overetch cleaning step, and during the removal of residual hardmask.

We now turn to the Examiner's § 103 rejection over Ying in view of Egger. Based on Egger's disclosure that TiAlN is a suitable alternative for TiN as a hardmask for patterning with a halogen etchant, we fully concur with the Examiner's legal conclusion that "[i]t would have been obvious to one with ordinary skill in the art to use TiAlN as the hardmask in the method of Ying" (Ans. 4, second para.). We find no merit in Appellants' argument that Egger "discloses the use of CO-based chemistries to etch materials (paragraphs 0004 and 0027); however Egger et al. does not disclose etching with chlorine chemistries" (Br. 44, third para.). Paragraph [0004] of Egger expressly discloses that etching "is performed using halogen or CO-based chemistry." Manifestly, halogen chemistry includes chlorine chemistry and we are convinced that one of ordinary skill in the art would have understood that Egger describes chlorine etching. Regarding the claim 19 recitation of an SF₆-based plasma etchant, Appellants have not challenged the Examiner's taking official notice that SF₆ is a conventional etchant (Ans. 8, first para.).

The remaining arguments advanced by Appellants, which are essentially repeated throughout the voluminous 121 page Brief, have been adequately answered by the Examiner. We do note, however, with respect to the § 103 rejection, Appellants base no argument upon objective evidence of nonobviousness, such as unexpected results.

In conclusion, based on the foregoing and the reasons well stated by the Examiner, the Examiner's decision rejecting the appealed claims is affirmed.

Appeal 2008-3203
Application 10/426,502

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)(effective Sept. 13, 2004).

AFFIRMED

cam

TEXAS INSTRUMENTS INCORPORATED
P O BOX 655474, M/S 3999
DALLAS, TX 75265