

The opinion in support of the decision being entered today was not written for publication in a law journal and is not binding precedent of the Board.

Paper No. 16

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte ROBERT C. CHEN, JEFFREY A. SHIELDS,
ROBERT DAWSON, and KHANH TRAN

Appeal No. 2001-0274
Application No. 09/136,527

ON BRIEF

Before KRASS, RUGGIERO, and BARRY, Administrative Patent Judges.
KRASS, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal from the final rejection of claims 1-7 and 9-16, all of the pending claims.

The invention is directed to a semiconductor device that seeks to solve the problem of "punch-through" that occurs when a through-hole is etched so deep as to cut through an anti-

Appeal No. 2001-0274
Application No. 09/136,527

reflective coating, exposing the primary conductive layer.

Independent claim 1 is reproduced as follows:

1. A semiconductor device, comprising:

a first dielectric layer;

a patterned metal layer having gaps, said patterned metal layer formed on the first dielectric layer and including a metal feature with an upper surface, said patterned layer having a composite structure comprising a bottom layer, an intermediate metal layer, and an upper anti-reflective coating;

a second dielectric layer formed on the patterned metal layer;

a through-hole having an internal surface formed in the second dielectric layer exposing a portion of the upper surface of the metal feature, wherein the exposed portion of the upper surface has a concave section formed during etching the through-hole, said concave section extending beneath and undercutting the anti-reflective coating;

a layer of barrier metal lining the internal surface of the through-hole and the concave section extending beneath and undercutting the anti-reflective coating; and

conductive material filling the through-hole and forming a via.

The examiner relies on the following references:

Myers et al. [Myers]	5,470,790	Nov. 28, 1995
Sandhu et al. [Sandhu]	5,723,382	Mar. 3, 1998

Claims 1, 2, 9, 10 and 15 stand rejected under 35 U.S.C. 102(b) as anticipated by Myers.

Appeal No. 2001-0274
Application No. 09/136,527

Claims 3-7, 11-14 and 16 stand rejected under 35 U.S.C. 103 as unpatentable over Myers in view of Sandhu.

Reference is made to the briefs and answer for the respective positions of appellants and the examiner.

OPINION

With regard to independent claim 1, the examiner points to Figures 2 and 3 of Myers and identifies a first dielectric layer 204, a patterned metal layer 202 having gaps formed on the first dielectric layer, wherein the patterned metal layer has a metal feature with an upper surface and a composite structure comprising a bottom layer 22, an intermediate metal layer 224 and an upper anti-reflective coating 228, and a second dielectric layer 210 formed on the patterned metal layer. A through-hole 318 having an internal surface formed in the second dielectric layer exposes a portion of the upper surface of the metal feature, wherein the exposed portion of the upper surface has a concave section 320 (also seen in Figure 2 at 216) formed during etching the through-hole and the concave section extends beneath and undercuts the anti-reflective coating 228. A conductive

Appeal No. 2001-0274
Application No. 09/136,527

metal filling the through-hole and forming a via is shown at 212. While the layer of barrier metal lining the internal surface of the through-hole and the concave section extending beneath and undercutting the anti-reflective coating is not specifically shown in Figure 2, Myers makes clear, at column 7, lines 50-54, that a thin barrier layer of Ti and TiN are "blanket deposited over ILD 314 and into via hole 318 and anchor hole 320, with well-known techniques, such as sputtering." Thus, Myers clearly discloses the claimed layer of barrier metal lining the interior surface of the through-hole and the concave section.

Appellants contend that the description at column 7, lines 50-54, of Myers "does not disclose the geometry of its adhesion/barrier layer with reference to the undercut portion, and the notation "(not shown)" concedes that no drawing in Myers...illustrates what the adhesion/barrier layer is supposed to look like."

We agree with the examiner and will sustain the rejection of claim 1 under 35 U.S.C. 102(b).

Claim 1 does not call for any specific "geometry of the adhesion/barrier layer." It merely calls for a barrier metal lining the internal surface of the through-hole and the concave section extending beneath and undercutting the anti-reflective

Appeal No. 2001-0274
Application No. 09/136,527

coating. By teaching that a Ti and TiN barrier layer are blanket deposited over ILD 34 and into via hole 318 and anchor hole 320, Myers clearly teaches that a layer of barrier metal lines the internal surface of the through-hole and the concave section extending beneath and undercutting the anti-reflective coating. Notwithstanding the arguments of appellants and the examiner, no inherency need be shown for this explicit teaching of Myers.

Appellants also argue that sputtering, the only deposit method disclosed by Myers, will not result in the claimed structure. Perhaps sputtering will not result in a structure intended or disclosed by appellants, but Myers is very explicit in teaching blanket depositing into the via hole and into the anchor hole which is the concave section extending beneath and undercutting the anti-reflective coating and so Myers' structure will result in a layer of barrier metal lining the internal surface of the through-hole and the concave section extending beneath and undercutting the anti-reflective coating, as claimed. Moreover, Myers does not rely only on sputtering as it clearly suggests "other well-known techniques," sputtering being but one example.

With regard to the rejection of claims 2-6 and 9-16, appellants merely argue that neither Myers nor Sandhu teaches or

Appeal No. 2001-0274
Application No. 09/136,527

suggests the layer of barrier metal lining the internal surface of the through-hole and the concave section extending beneath and undercutting the anti-reflective coating. However, for the reasons supra, we hold that Myers does, indeed, disclose such a limitation.

Accordingly, we will sustain the rejections of claims 1-6 and 9-16 under 35 U.S.C. 102(b) and 103.

We turn now to the rejection of claim 7 under 35 U.S.C. 103 over Myers and Sandhu.

The examiner employs Sandhu for the teaching of a titanium nitride barrier layer 41 having the limitations recited in claims 3-7, 11-14 and 16. Appellants do not argue these teachings of Sandhu.

But, as to claim 7, appellants do argue that neither Myers nor Sandhu teaches or suggests the limitation of the anti-reflective coating having a thickness of about 250 to about 750 angstroms. The examiner agrees that the references do not teach this limitation but finds that this is an "obvious design choice" and "not patentable unless unobvious or unexpected results are obtained from these changes" [answer-page 7]. In response to appellants' argument, the examiner contends that because Myers teaches that the thickness of the anti-reflection layer 312

Appeal No. 2001-0274
Application No. 09/136,527

should be as thin as possible in order to reduce the need for excessively long via etches to reach aluminum alloy

layer 308, it would have been obvious to employ the thickness range claimed. We disagree.

Claim 7 is very specific as to the rather limited range of thicknesses for the anti-reflective coating. Moreover, at page 9 of the specification, appellants disclose that unexpected benefits are obtained in that the anti-reflective coating thickness can be substantially reduced with the unexpected formation of a CVD TiN barrier layer on the appropriate portions of the structure. Accordingly, it is not sufficient for the examiner to rely on "obvious design choices," without more, to establish obviousness of the instant claimed subject matter under 35 U.S.C. 103.

We will not sustain the rejection of claim 7 under 35 U.S.C. 103.

Since we have not sustained the rejection of claim 7 under 35 U.S.C. 103, while we have sustained the rejections of claims 1-6 and 9-16 under 35 U.S.C. 102(b) and 103, the examiner's decision is affirmed-in-part.

Appeal No. 2001-0274
Application No. 09/136,527

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

AFFIRMED-IN-PART

ERROL A. KRASS)	
Administrative Patent Judge)	
)	
)	
)	
)	
)	
JOSEPH F. RUGGIERO)	BOARD OF PATENT
Administrative Patent Judge)	APPEALS AND
)	INTERFERENCES
)	
)	
)	
LANCE LEONARD BARRY)	
Administrative Patent Judge)	

Appeal No. 2001-0274
Application No. 09/136,527

EK/RWK

MCDERMOTT WILL & EMERY
600 13TH STREET, N.W.
WASHINGTON, DC 20005-3096