

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

Paper No. 34

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte RAYMOND R. JIN, SHIJIAN LI, FRED C. REDEKER
and THOMAS H. OSTERHELD

Appeal No. 2003-0512
Application 09/184,805

ON BRIEF

Before ABRAMS, STAAB and NASE, *Administrative Patent Judges*.
STAAB, *Administrative Patent Judge*.

DECISION ON APPEAL

This is a decision on an appeal from the examiner's final rejection of claims 1-21 and 29, all the claims currently pending in the application.

Appellants' invention pertains to a method of chemical mechanical polishing a substrate having a filler layer and a stop layer. Independent claim 1 is exemplary of the appealed subject matter and reads as follows:

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1. A method of chemical mechanical polishing a substrate having a filler layer disposed on a stop layer, comprising:

chemical mechanical polishing the filler layer of the substrate with a first slurry until the stop layer is partially covered by the filler layer and partially exposed; and

chemical mechanical polishing the substrate with a second slurry which has a lower selectivity than the first slurry until the stop layer is substantially completely exposed.

The references relied upon by the examiner as evidence of obviousness are:

Cadien et al. (Cadien)	5,340,370	Aug. 23, 1994
Landers et al. (Landers)	5,676,587	Oct. 14, 1997

In addition, the examiner relies upon Applicants' Admitted Prior Art (AAPA) in rejecting certain of the appealed claims. On page 3-4 of the answer, the examiner has identified AAPA as corresponding to the disclosure in appellants' specification at page 4, line 15, through page 6, line 9.

Claims 1, 20, 21 and 29 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Cadien in view of Landers.

Claims 2-19 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Cadien in view of Landers as applied in the rejection of claim 1 et al., and further in view of AAPA.

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Reference is made to appellants' main and reply briefs (Paper Nos. 28 and 31) and to the examiner's answer (Paper No. 29) for the respective positions of appellants and the examiner regarding the merits of these rejections.

Discussion

Each of the independent claims on appeal, in one way or another, calls for the step of chemical mechanical polishing the filler layer of the substrate with a first slurry *until the stop layer is partially covered by the filler layer and partially exposed*, and the step of chemical mechanical polishing the substrate with a second slurry *until the stop layer is substantially completely exposed*.

Cadien, the examiner's primary reference, is directed to novel slurries for chemical mechanical polishing substrates. The method of chemical mechanical polishing disclosed in Cadien that uses the novel slurries starts by providing a substrate (see Fig. 3b) that comprises a conductive layer 301, an interlayer dielectric layer 302 for electrically isolating the conductive layer from a subsequently formed conductive layer, a titanium contact layer 305 which functions to improve electrical performance, a titanium nitrate adhesion layer 306 which provides an adhesion layer and a diffusion barrier for a subsequently

deposited tungsten layer, and a tungsten layer 309. Cadien's method comprises polishing the tungsten layer 309 with a first slurry (column 6, line 36 to column 8, line 43), polishing the titanium nitrate adhesion layer 306 with a second slurry (column 8, lines 43 to 66), and polishing the titanium contact layer 305 with a third slurry (column 8, line 67 to column 9, line 52). The resulting polished substrate is illustrated in Fig. 3d. Central to Cadien is the utilization of a specifically engineered slurry for polishing each of the layers 308, 306 and 305.

In rejecting the appealed claims, the examiner found, and appellants did not dispute, that Cadien discloses polishing the filler layer 308 of a substrate with a first slurry and a second slurry, wherein the slurries have different selectivities.¹ The examiner concedes that Cadien does not disclose polishing the filler layer with the first slurry until the stop layer is partially covered and partially exposed, and then polishing the filler layer with the second slurry until the stop layer is substantially exposed, as called for in the claims. The examiner

¹In accordance with appellants' specification, the "selectivity" of a slurry as used in the appealed claims refers to the ratio of the polishing rate of the filler layer to the polishing rate of the stop layer. Specification, page 8, lines 29-33.

turns to Landers for a teaching of these features.

Landers pertains to an improved polishing method for selectively removing a layer of metallization material 10 such as tungsten and a liner film 12 such as Ti/TiN from the surface of an oxide layer 18 of a semiconductor wafer. As set forth in the abstract (with drawing figure and reference numeral added):

The method includes removing the metallization and liner layers [10 and 12, respectively] with a first removal process which utilizes CMP polishing and an alumina-based slurry. The first removal process is stopped after the metallization layer [10] is completely removed . . . [see Fig. 2]. The remainder of the liner film [12] is completely removed [see Fig. 3] using a second removal process which includes CMP polishing using a neutral pH silica-based slurry which is selective to the liner film [12].

According to the examiner (answer, page 3), Landers "discloses a method of CMP comprising: CMP [polishing] a layer 12 of the substrate with the first slurry until the layer is partially exposed and CMP [polishing] of the same layer with the second slurry of lower selectivity until the layer is substantially exposed . . ." (answer, page 3). The examiner concludes that it would have been obvious to one of ordinary skill in the art "to CMP [i.e., polish] the filler layer of Cadien with multiple slurries in view of Landers to more

precisely remove the filler layer from the stop layer" (answer, page 3). In response to appellants' argument in the main brief questioning the examiner's finding that Landers discloses polishing with a first slurry until the layer 18 is only partially exposed, the examiner states the following:

Landers does indeed disclose that the layer 18 is partially covered and partially exposed after the first polishing step. In support of the Examiner's position, attention is directed to figures 1-3 of Landers. Figure 1 illustrates a layer 10, succeeded by a layer 12, and then succeeded further by a layer 14. Figure 2 clearly illustrates that after polishing, layer 12 is partially exposed and partially covered by the remains of layer 10 in the trench. This meets the broad independent claim[s] that Appellant[s] set forth. [Answer, page 4.]

We have carefully considered the examiner's findings of fact and conclusions of obviousness and have concluded that they are not well founded. First, it is not apparent to us that the modification of Cadien proposed by the examiner, namely, "[polishing] the filler layer [308] of Cadien with multiple slurries . . . to more precisely remove the filler layer [308] from the stop layer [306, 305, and/or 302]" (answer, page 3), would result in the claimed step of polishing the filler layer with a first slurry until the stop layer *is partially covered by the filler layer and partially exposed*.

In any event, we cannot accept the examiner's finding that Landers teaches polishing the filler layer of a substrate with a first slurry until a stop layer is partially covered by the filler layer and partially exposed, and then polishing the substrate with a second slurry until said stop layer is substantially completely exposed, as now claimed. In Landers, we perceive the metallization layer 10 as corresponding to the claimed filler layer and oxide layer 18 (also denominated by reference numeral 14) as corresponding to the claimed stop layer.

As to liner layer 12, which may comprise Ti/TiN or Ta/TaN depending on the composition of the metallization layer 10, if the liner layer is considered to be part of the metallization layer, then oxide or stop layer 18 is completely covered by the "filler layer" (layer 10 + layer 12) at the end of Landers' first polishing step (see Fig. 2) and Landers does not teach the claimed first step of polishing with a first slurry until the stop layer (i.e., layer 18) is partially covered by the filler layer and partially exposed. On the other hand, if the liner layer is considered to be part of the oxide layer, then the "stop layer" (layer 12 + layer 18) is partially covered by the plug 28 at the end of Landers' second polishing step (see Fig. 3) and Landers does not teach the claimed second step of polishing with

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a second slurry until the "stop layer" (layer 12 + layer 18) is substantially completely exposed.

We have also considered the possibility that the examiner considers liner layer 12 alone as corresponding to either the claimed filler layer or the claimed stop layer, and have arrived at unsatisfactory results analogous to those set forth above. Thus, regardless of how one attempts to read the claimed filler layer and stop layer on the layers 10, 12 and 18 of Landers, Landers fails to teach the particulars of either the first polishing step or the second polishing step.

In light of the foregoing, we shall not sustain the examiner's rejection of claims 1, 20, 21 and 29 as being unpatentable over Cadien in view of Landers.

Looking at the rejection of claims 2-19 as being unpatentable over Cadien in view of Landers and further in view of AAPA, the tertiary teachings of AAPA do not make up for the deficiencies of Cadien and Landers discussed above. Therefore, we also shall not sustain the examiner's rejection of these claims.

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New Ground of Rejection

Pursuant to our authority under 37 CFR § 1.196(b), we enter the following new rejection.

Claims 14 and 15 are rejected under 35 U.S.C. § 112, second paragraph.

In order to satisfy the second paragraph of § 112, a claim must accurately define the claimed subject matter in the technical sense. See *In re Knowlton*, 481 F.2d 1357, 1365, 178 USPQ 486, 492 (CCPA 1973). Moreover, while the claim language may appear, for the most part, to be understandable when read in the abstract, no claim may be read apart from and independent of the supporting disclosure on which it is based. *In re Cohn*, 438 F.2d 989, 993, 169 USPQ 95, 98 (CCPA 1971); *In re Moore*, 439 F.2d 1232, 1235 n.2, 169 USPQ 236, 238 n.2 (CCPA 1971).

Applying these principles to the present case, while the claim language "a barrier layer . . . disposed between the filler layer and the stop layer" appearing in claim 14 may appear to be reasonably clear when read in a vacuum, this claim language, when read in light of appellants' supporting disclosure, and especially drawing Figure 4C, raises an unreasonable degree of uncertainty as to what the claim language may mean. More particularly, in appellants' disclosed barrier layer embodiment

(see Figures 4A through 4E), the stop layer 14 is not disclosed as being partially covered by the filler layer 18 as a result of the first polishing step, but is instead partially covered by remnants of the barrier layer material 16. This is clearly shown in Figure 4C and described in the paragraph bridging pages 11 and 12 of the specification. Accordingly, it is not clear how claim 14, which is directed to the barrier layer embodiment, can properly depend from claim 1, which calls for the step of polishing the filler layer with a first slurry until the stop layer is partially covered by the filler material.

Summary

Each of the examiner's rejections is reversed.

Accordingly, the decision of the examiner finally rejecting the appealed claims is reversed.

A new rejection pursuant to 37 CFR § 1.196(b) has been entered.

This decision contains a new ground of rejection pursuant to 37 CFR § 1.196(b). 37 CFR § 1.196(b) provides that, "[a] new ground of rejection shall not be considered final for purposes of judicial review."

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37 CFR § 1.196(b) also provides that the appellant, WITHIN TWO MONTHS FROM THE DATE OF THE DECISION, must exercise one of the following two options with respect to the new ground of rejection to avoid termination of proceedings (§ 1.197(c)) as to the rejected claims:

(1) Submit an appropriate amendment of the claims so rejected or a showing of facts relating to the claims so rejected, or both, and have the matter reconsidered by the examiner, in which event the application will be remanded to the examiner. . . .

(2) Request that the application be reheard under § 1.197(b) by the Board of Patent Appeals and Interferences upon the same record. . . .

REVERSED; 37 CFR § 1.196(b)

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NEAL E. ABRAMS)	
Administrative Patent Judge)	
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LAWRENCE J. STAAB)	
Administrative Patent Judge)	APPEALS AND
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)	INTERFERENCES
)	
JEFFREY V. NASE)	
Administrative Patent Judge)	

LJS/ki

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Applied Materials, Inc.
2881 Scott Blvd., M/S 2061
Santa Clara, CA 95050