

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.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. 22

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte MATTHEW S. BUYNOSKI

Appeal No. 2001-1093
Application 09/252,186

ON BRIEF

Before HAIRSTON, RUGGIERO, and DIXON, Administrative Patent Judges.

HAIRSTON, Administrative Patent Judge.

DECISION ON APPEAL

This is an appeal from the final rejection of claims 1 through 10 and 21 through 33. In a first Amendment After Final (paper number 12), claim 28 was amended, and claims 32 and 33 were canceled. Accordingly, claims 1 through 10 and 21 through 31 remain before us on appeal.

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The disclosed invention relates to the use of a metal silicide liner on metal features and vias of a semiconductor device.

Claim 1 is illustrative of the claimed invention, and it reads as follows:

1. A semiconductor device comprising:
 - a substrate having active regions; and
 - an interconnection system comprising:
 - a first patterned metal layer, comprising metal features, over the substrate;
 - a plurality of patterned metal layers, each patterned metal layer containing metal features, above the first patterned metal layer terminating with an uppermost patterned metal layer;
 - vias electrically connecting metal features of different patterned metal layers;
 - contacts electrically connecting active regions to metal features of the first patterned metal layer;
 - air gaps between the patterned metal layers, metal features, and vias; and
 - a metal silicide liner on the metal features and vias, wherein the air gaps are substantially continuous throughout the interconnection system.

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The references relied on by the examiner are:

Ho ('841)	4,898,841	Feb. 6, 1990
Ho ('214)	4,954,214	Sept. 4, 1990
Hause et al. (Hause)	5,953,626	Sept. 14, 1999 (filed June 5, 1996)
Ahn	6,037,248	Mar. 14, 2000 (filed June 13, 1997)

Claims 1 through 10¹, 21 through 24 and 28 through 31 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hause in view of Ahn and Ho '214.

Claims 25 through 27 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hause in view of Ahn, Ho '214 and Ho '841.

Reference is made to the briefs (paper numbers 16 and 19) and the answer (paper number 18) for the respective positions of the appellant and the examiner.

OPINION

We have carefully considered the entire record before us, and we will reverse the obviousness rejections of claims 1 through 10 and 21 through 31.

Appellant and the examiner agree that Hause fails to

¹The provisional double patenting rejection of claims 1 through 10 is no longer before us as a result of the submission of a terminal disclaimer (paper number 20).

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disclose a metal silicide liner on the metal features and the vias of a semiconductor device (brief, page 8; answer, page 5). According to the examiner (answer, page 6), "Ahn teaches in figure 10 a plurality of patterned metal layers comprising aluminum, copper or an alloy thereof (column 4, line 65) containing metal features and vias (column 1, lines 23-28), and air gaps 56, substantially continuous throughout the interconnection system, between the patterned metal layers, metal features and vias, and a conductive liner 44, 52 used as an adhesion promoter layer (column 4, lines 60-62) substantially enveloping metal features and vias," and "Ho ['214] teaches in figure 2e a conductive liner 200, 208 being an adhesion promoter layer (column 4, lines 27-29) and comprising tungsten silicide (column 7, line 44) of thickness between 500 to 1000 Å, on and around interconnect structures 210." Based upon the teachings of Ahn and Ho, the examiner is of the opinion (answer, pages 5 and 6) that:

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to form a metal silicide liner on the metal features and the vias in Hause et al.'s device in order to enhance the conductivity of the device, improve the reliability of the device and to prevent the formation of open circuits and short circuits during the etching process of making the device. The combination is motivated by the teachings of Ahn who points out the advantages of

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using a conductive liner (adhesion promoter layer) to envelope interconnection system having an air gap therein. Ahn further teaches an artisan that the adhesion promoter layer can be formed of metals other than refractory metals (column 5, lines 64-65). Ho teaches the advantages of using a metal silicide liner as an adhesion promoter layer on interconnect structures (column 4, lines 22-29), wherein an adhesion promoter metal silicide liner can replace an adhesion promoter liner comprising aluminum and refractory metal (column 7, lines 49-54).

The examiner's contentions to the contrary notwithstanding, the evidentiary record before us does not support any of the so-called motivational statements (e.g., enhancing the conductivity of the device, improving the reliability of the device and preventing the formation of open circuits and short circuits during an etching process) for modifying the teachings of Hause with those of Ahn and Ho. As stated in In re Lee, 277 F.3d 1338, 1343-44, 61 USPQ2d 1430, 1434 (Fed. Cir. 2002) ("The examiner's conclusory statements . . . do not adequately address the issue of motivation to combine. This factual question of motivation is material to patentability, and could not be resolved on subjective belief and unknown authority. It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to '[use] that which the inventor taught against its teacher.'"). Although Ahn discloses the use of copper alloys formed from a refractory metal

(e.g., titanium) in adhesion promoter layers 44 and 52 (Figure 10; column 4, line 53 through column 5, line 24), and Ho uses a refractory metal (e.g., tungsten) in a metal silicide seed layer 200 and 208 for a subsequent deposit of tungsten in an opening 204 of a semiconductor device (Figure 2e; column 4, lines 2 through 30 and column 7, lines 3 through 54), the examiner has not successfully demonstrated via substantial evidence in the record how and why the skilled artisan would have found it obvious to rely on the disparate copper alloy teachings of Ahn and the metal silicide teachings of Ho to provide the "metal features and vias" in Hause with a metal silicide liner. Thus, the obviousness rejection of claims 1 through 10, 21 through 24 and 28 through 31 is reversed because we agree with the appellant's argument (reply brief, page 5) that "[t]he Examiner's interpretation of the seedlayer of Ho '214 and photoresist adhesion promoter of Ahn as a conductivity enhancing feature for the system of Hause et al., when viewed in light of Appellant's disclosure, is clearly an **improper retrospective assessment** of the applied prior art in light of Appellant's disclosure."

The obviousness rejection of claims 25 through 27 is reversed because the metal silicide teachings of Ho '841 fail to

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cure the noted shortcoming in the teachings of Hause, Ahn and Ho
'214.

DECISION

The decision of the examiner rejecting claims 1 through 10
and 21 through 31 under 35 U.S.C. § 103(a) is reversed.

REVERSED

KENNETH W. HAIRSTON)	
Administrative Patent Judge)	
)	
)	
)	BOARD OF PATENT
JOSEPH F. RUGGIERO)	APPEALS AND
Administrative Patent Judge)	INTERFERENCES
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JOSEPH L. DIXON)	
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KWH:svt

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