

The opinion in support of the decision being entered today was not written for publication in a law journal and is not binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte JOHN H. GIVENS

Appeal No. 2005-0479
Application No. 08/801,812

ON BRIEF

Before KIMLIN, OWENS and WALTZ, Administrative Patent Judges.
KIMLIN, Administrative Patent Judge.

DECISION ON APPEAL

This is an appeal from the final rejection of claims 1-28 and 36-63. Claims 1 and 46 are illustrative:

1. A method for manufacturing an interconnect structure comprising:

forming a recess within a dielectric material situated on a semiconductor lower substrate, said recess extending below a top surface of said dielectric material;

forming a diffusion barrier layer on the recess within the dielectric material;

forming a seed layer on the diffusion barrier layer, the diffusion barrier layer being composed of a material having a

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melting point greater than or equal to that of a material from which the seed layer is composed;

forming an electrically conductive layer on the seed layer including the portion of the seed layer within said recess, the material from which the diffusion barrier layer is composed having a melting point greater than that of a material from which the electrically conductive layer is composed, the material from which the seed layer is composed having a melting point greater than or equal to that of the material from which the electrically conductive layer is composed;

forming an energy absorbing layer on said electrically conductive layer, said energy absorbing layer having a greater thermal absorption capacity than that of said electrically conductive layer;

applying, omnidirectionally, energy to said energy absorbing layer to cause said electrically conductive layer to flow within said recess; and

removing portions of the energy absorbing layer and the electrically conductive layer that are situated above the top surface of the dielectric material.

46. A method for manufacturing an interconnect structure, the method comprising:

forming a dielectric material over a semiconductor substrate and having a top surface;

forming a recess within the dielectric material extending from the top surface of the dielectric material to the semiconductor substrate;

filling the recess with an electrically conductive material, wherein filling the recess with the electrically conductive material further comprises:

forming a diffusion barrier layer in contact with the semiconductor substrate and the dielectric material;

forming a seed layer upon the diffusion barrier layer and composed of a material having a melting point less than

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that of the material from which the diffusion barrier layer is composed and being selected from a group consisting of ceramics, metallics, and intermetallics;

forming a conductor layer upon the seed layer including the portion of the seed layer within said recess; and

forming an energy absorbing layer on the conductor layer that is composed of a material having both a higher thermal insulation capacity and electric insulation capacity than that of the material from which the conductor layer is composed;

wherein the recess includes:

a first portion having an uniform width and extending within the dielectric material to the top surface of the dielectric material;

a second portion having a height and a uniform width that is less than the width of the first portion and that is not greater than 25% of the height, the second portion extending from the semiconductor substrate to terminate at the first portion; and

wherein the filling the recess is performed by causing the electrically conductive material to flow within the recess by applying omnidirectional heating.

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

Xu et al. (Xu '461)	5,847,461	Dec. 8, 1998
Yim	5,869,395	Feb. 9, 1999
Xu et al. (Xu '721)	6,217,721 B1	Apr. 17, 2001

Appellant's claimed invention is directed to a method for making an interconnect structure which entails forming diffusion barrier, seed and electrically conductive layers within a recess in a dielectric material situated on a substrate. The

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electrically conductive layer is formed on the seed layer and has an energy absorbing layer formed thereon which causes the conductive layer to flow within the recess when energy is applied to the energy absorbing layer.

The appealed claims stand rejected under 35 U.S.C. § 103 as follows:

(a) claims 1, 3-5, 7-11 and 36-45 over Xu '461 in view of Xu '721;

(b) claims 2, 6 and 12-15 over Xu '461 in view of Xu '721 and Yim;

(c) claims 16-28 and 57-63 over Xu '461 in view of Xu '721 and Yim; and

(d) claims 46-56 over Xu '461 in view of Xu '721 and Yim.

Appellant submits at page 4 of the Brief that the following groups of claims stand or fall together: (I) claims 1-15 and 36-45; (II) claims 16-28 and 57-63; and (III) claims 46-56.

However, since appellant has presented substantive arguments only for the subject matter defined by claims 1 and 46, we will limit our consideration to the examiner's rejections of claims 1 and 46.

We have thoroughly reviewed each of appellant's arguments for patentability. However, we are in complete agreement with

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the examiner that the claimed subject matter would have been obvious to one of ordinary skill in the art within the meaning of § 103 in view of the applied prior art. Accordingly, we will sustain the examiner's rejections for the reasons set forth in the Answer, which we incorporate herein, and we add the following primarily for emphasis.

Appellant does not dispute the examiner's factual determination that Xu '461 discloses many of the claimed steps for making an interconnect structure with the exception of heating the diffusion barrier layer in an environment substantially containing nitrogen gas and forming a seed layer on the diffusion barrier layer. Also, appellant does not contest the examiner's legal conclusion that, based on Xu '721, it would have been obvious for one of ordinary skill in the art to heat the diffusion barrier layer in a nitrogen environment. Indeed, independent claims 1 and 46, with which all the appealed claims stand or fall, fail to recite the step of heating in an environment containing nitrogen gas.

The principal argument advanced by appellant is that Xu '461 provides a "teaching away" from utilizing the seed layer presently claimed and disclosed by Xu '721. In support of this argument appellant cites Xu '461 at column 1, line 56 through

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column 2, line 27. However, we do not subscribe to appellant's position that the reference disclosure is tantamount to a teaching away from using seed layers, in general, in methods of forming interconnect structures of the type disclosed by Xu '461. Rather, we find that the cited portion of Xu '461 is particularly specific to seed layers of tungsten which sometimes result in the formation of undesirable crystallographic forms of aluminum. Xu '461 provides no teaching away of using the presently claimed seed layer of titanium nitride, which is also the seed layer used by Xu '721. Furthermore, as for the use of the seed layer resulting in more complexity, cost and less reliability in the process, this would seem to apply to appellant's process as well. Appellant has submitted no argument, let alone evidence, that the process of the instant invention is not more complex and costly than processes that eschew seed layers. It is well settled that it is a matter of obviousness for one of ordinary skill in the art to eliminate or include a feature of the prior art, along with its attendant advantages and disadvantages. As explained by the examiner, the prior art establishes that it was known in the art to employ seed layers in methods for forming interconnect structures of the type claimed.

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Concerning the particular size and profile of the recess recited in claim 46 on appeal, we fully concur with the examiner that it is a matter of prima facie obviousness for one of ordinary skill in the art to resort to routine experimentation to determine the optimum dimensions of a structure. Appellant points to no disclosure of criticality for the profile of the claimed recess in the present specification. Moreover, Yim discloses a recess profile that generally corresponds to the profile of the claimed recess in the sense that it has a second portion that is less in width than the first portion.

As a final point, we note that appellant bases no argument upon objective evidence of nonobviousness, such as unexpected results, which would serve to rebut the inference of obviousness established by the examiner.

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

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No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a)(1)(iv) (effective Sep. 13, 2004; 69 Fed. Reg. 49960 (Aug. 12, 2004); 1286 Off. Gaz. Pat. Office 21 (Sep. 7, 2004)).

AFFIRMED

EDWARD C. KIMLIN)	
Administrative Patent Judge)	
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TERRY J. OWENS)	BOARD OF PATENT
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THOMAS A. WALTZ)	
Administrative Patent Judge)	

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Gregory M. Taylor
Workman, Nydegger & Seeley
1000 Eagle Gate Tower
60 East South Temple
Salt Lake City, UT 84111