Paper No. 34

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte SYUN-MING JANG
and CHEN-HUA YU

Appeal No. 2001-0430
Application No. 08/697,699

ON BRIEF

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

HAIRSTON, Administrative Patent Judge.

DECISION ON APPEAL

This is an appeal from the final rejection of claims 1, 2, 4 through 6, 8 through 10 and 24.

The disclosed invention relates to a method of forming a gap filling sandwich composite dielectric layer construction for use within an integrated circuit. A gap filling dielectric layer is sandwiched between a first and a second conformal dielectric layer. The first conformal dielectric layer is formed through a first plasma enhanced chemical vapor deposition (PECVD) of a first

source material using a single first radio frequency (RF) power, and the second conformal dielectric layer is formed through a second PECVD of a second source material using a second RF power.

Claim 1 is the only independent claim on appeal, and it reads as follows:

1. A method for forming for use within an integrated circuit a gap filling sandwich composite dielectric layer construction comprising:

providing a substrate;

forming upon the substrate a patterned layer;

forming upon the patterned layer a single layer first conformal dielectric layer, the single layer first conformal dielectric layer being formed through a first plasma enhanced chemical vapor deposition (PECVD) method employing a first source material, the first plasma enhanced chemical vapor deposition (PECVD) method also employing a single first radio frequency power optimized primarily to limit plasma induced damage to the substrate and the patterned layer, the single first radio frequency power also being optimized secondarily to limit moisture permeation through the single layer first conformal dielectric layer;

forming upon the single layer first conformal dielectric layer a gap filling dielectric layer; and

forming upon the gap filling dielectric layer a second conformal dielectric layer, the second conformal dielectric layer being formed through a second plasma enhanced chemical vapor deposition (PECVD) method employing a second source material, the second plasma enhanced chemical vapor deposition (PECVD) method also employing a second radio frequency power optimized primarily to limit moisture permeation through the second conformal dielectric layer.

The references relied on by the examiner are:

Kocmanek et al. (Kocmanek)	5,252,520	Oct. 12, 1993
Cain et al (Cain)	5,286,518	Feb. 15, 1994
Machida et al. (Machida)	5,376,590	Dec. 27, 1994
Jain et al. (Jain)	5,403,780	Apr. 4, 1995
Dawson	5,503,882	Apr. 2, 1996
Ngo	5,736,423	Apr. 7, 1998 (filed Nov. 16, 1995)

Claims 1, 4, 5 and 8 through 10 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Dawson in view of Kocmanek and Cain.

Claims 1, 2, 4 through 6, 8 through 10 and 24 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Dawson in view of either Machida or Jain.

Claims 1, 2, 4 through 6, 8 through 10 and 24 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Dawson in view of Kocmanek and Cain and either one of Machida or Jain.

Claims 1, 2, 4 through 6, 8 through 10 and 24 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Dawson in view of either Machida or Jain and in further view of Ngo.

Claims 1, 2, 4 through 6, 8 through 10 and 24 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Dawson in view of Kocmanek and Cain and either one of Machida or Jain and in further view of Ngo.

Reference is made to the briefs (paper numbers 29 and 31) and the answer (paper number 30) for the respective positions of the appellants and the examiner.

OPINION

We have carefully considered the entire record before us, and we will reverse the obviousness rejections of claims 1, 2, 4 through 6, 8 through 10 and 24.

Appellants acknowledge (brief, page 8) that Dawson discloses first and second conformal dielectric layers 40 and 52 formed by first and second PECVD methods, respectively. Dawson provides "the second conformal dielectric layer 52 with inhibited moisture permeation (paragraph bridging cols. 8-9)" (brief, page 8). Kocmanek discloses an integrated circuit with a first dielectric layer 17 and a second dielectric layer 21 (Figure 1). Using PECVD, Kocmanek forms an initial portion of dielectric layer 21 using a first source material flow rate, and thereafter forms the final portion of the dielectric layer 21 by depositing the same source material at a second flow rate (Abstract; column 1, lines 47 through 55; column 2, lines 28 through 41). Cain, like Kocmanek, uses PECVD to form two adjacent dielectric layers 190 and 192. The first dielectric layer 190 is deposited at a low RF power of 100 watts, and the second dielectric layer 192 is deposited at a higher RF power of 300 watts (column 2, lines 31 through 45; column 3, lines 4 through 14; column 5, lines 16 through 28). Appellants argue (brief, pages 13 and 14) that "each of Kocmanek (Abstract) and Cain (Abstract) disclose a corresponding conformal dielectric layer formed employing a corresponding plasma enhanced chemical vapor (PECVD) method as a bilayer conformal dielectric layer employing a pair of radio frequency powers rather than a single layer conformal dielectric layer formed employing a single radio frequency power." We agree. Thus, the obviousness rejection of claims 1, 4, 5 and 8 through 10 based upon the combined teachings of Dawson, Kocmanek and Cain is reversed because "the combination of Dawson with Kocmanek and

Cain provides a bilayer conformal dielectric layer inapposite to applicant's single layer conformal dielectric layer as disclosed and claimed . . ." (brief, page 15).

Turning to the obviousness rejection of claims 1, 2, 4 through 6, 8 through 10 and 24 based upon the combined teachings of Dawson, and either one of Machida or Jain, appellants acknowledge (brief, pages 16 and 17) that Machida discloses a sandwich composite dielectric layer construction formed, in part, by employing "a first conformal dielectric layer formed employing a plasma enhanced chemical vapor deposition (PECVD) method employing silane as a silicon source material and oxygen as an oxidant source material, at a prescribed silane oxygen flow rate ratio . . . ," and that "[a]t col. 14, lines 5-45, Machida also discloses that the sandwich composite dielectric layer construction may also employ a second conformal dielectric layer formed employing a second plasma enhanced chemical vapor deposition (PECVD) method employing tetraethylorthosilicate (TEOS) as a second silicon source material, such as to promote within the sandwich composite dielectric layer construction moisture permeation through the second conformal dielectric layer . . . ." Appellants likewise acknowledge (brief, page 17) that Jain uses PECVD to form the adjacent dielectric layers 60 and 80 (prior art Figure 2B; column 1, lines 54 through 61; column 3, lines 37 through 42). Appellants argue (brief, page 19) that neither Machida nor Jain provides a disclosure of optimizing radio frequency power when forming a conformal dielectric layer within a gap filling sandwich composite dielectric layer construction. We agree. The obviousness rejection of claims 1, 2, 4 through 6, 8 through 10 and 24 is, therefore, reversed because of the silence of Dawson, Machida and Jain as to power used when forming the conformal dielectric layers.

Ngo discloses that a conventional wattage of 1000 watts or a reduced wattage of 500 watts may be used in a PECVD process for forming silicon dioxide (Abstract; column 1, lines 24 through 28; column 3, lines 7 through 26).

In view of the teachings of Dawson, Machida, Jain and Ngo, the obviousness rejection of claims 1, 2, 4 through 6, 8 through 10 and 24 based upon the combined teachings of these references is reversed because we agree with appellants' argument (brief, page 19) that neither of these references provides " a disclosure of optimizing a radio frequency power . . . when forming a conformal dielectric layer within a gap filling sandwich composite dielectric layer construction."

With respect to the obviousness rejections of claims 1, 2, 4 through 6, 8 through 10 and 24 based upon the combined teachings of Dawson, Kocmanek and Cain, and either Machida or Jain or alternatively the same combination of teachings with the additional teachings of Ngo, the above-noted shortcomings in the teachings of these references negate any suggestion or motivation for combining the teachings and suggestions of the references. Accordingly, the obviousness rejections of these claims are reversed.

DECISION

The decision of the examiner rejecting claims 1, 2, 4 through 6, 8 through 10 and 24 under 35 U.S.C. § 103(a) is reversed.

REVERSED

KENNETH W. HAIRSTON Administrative Patent Judge	)))))) BOARD OF PATENT
JOSEPH L. DIXON Administrative Patent Judge	) APPEALS) AND) INTERFERENCES
HOWARD B. BLANKENSHIP Administrative Patent Judge	))))

KWH/lp

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