UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte DANIEL W. BEDELL,
GREGOR BREYTA,
TOM K. HARRIS, III,
APRIL D. HIXSON-GOLDSMITH,
MURALI RAMASUBRAMANIAN,
ALFRED RENALDO and
BENJAMIN L. WANG

Appeal 2008-5011
Application 10/733,097
Technology Center 1700

Decided: September 10, 2008

Before CHARLES F. WARREN, TERRY J. OWENS, and
CATHERINE Q. TIMM, *Administrative Patent Judges*.

OWENS*, Administrative Patent Judge*.

DECISION ON APPEAL

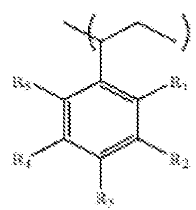
The Appellants appeal from a rejection of claims 1-14 and 36. Claims 15-28 stand allowable, claims 29, and 31-35 stand withdrawn from consideration by the Examiner, and claim 30 has been canceled.

THE INVENTION

The Appellants claim methods for plating and for preventing exposure of protected portions of a substrate during plating. Claim 1 is illustrative:

1. A method for plating, comprising:

coating a substrate with a barrier layer, wherein the barrier layer comprises an adhesive composition comprising a polyphenolic polymer, said polyphenolic polymer comprising repeating monomeric units having the formula



wherein each of R_1, R_2, R_3, R_4, and R_5 are each individually a hydroxy group, hydrogen, or an azo dye moiety;

coating the barrier layer with a top layer comprising a photoresist;

imagewise exposing the top layer to radiation;

removing a portion of the top layer for exposing a portion of the barrier layer;

removing the exposed portion of the barrier layer for exposing a portion of the substrate; and

plating a material on the exposed portion of the substrate.

THE REFERENCES

Hawkins	US 5,006,202	Apr. 9, 1991
Whewell	US 5,017,271	May 21, 1991
Pinarbasi	US 6,218,056 B1	Apr. 17, 2001

Breyta	US 2001/0005741 A1	Jun. 28, 2001
Lee	US 6,866,987 B2	Mar. 15, 2005 (filed Feb. 20, 2003)

THE REJECTIONS

The claims stand rejected under 35 U.S.C. § 103 as follows: claims 1-8, 13, and 14 over Breyta in view of Whewell; claims 9-11 over Breyta in view of Whewell and Lee; claim 12 over Breyta in view of Whewell and Pinarbasi; and claim 36 over Breyta in view of Whewell and Hawkins.

OPINION

The rejections are affirmed as to claims 1-8, 13, 14, and 36, and reversed as to claims 9-12.

Rejection of claims 1-8, 13 and 14

The Appellants argue claims 1-8, 13, and 14 as a group (Br. 10-12). We therefore limit our discussion to one claim in that group, i.e., claim 1. Claims 2-8, 13, and 14 stand or fall with claim 1. *See* 37 C.F.R. § 41.37(c)-(1)(vii) (2007).

Breyta discloses an adhesive composition comprising a polyphenolic polymer having repeating monomeric units of the formula in the Appellants' claim 1, except that only one of Breyta's R groups can be a hydroxyl group (¶ 0008).[1] Breyta coats a substrate with the polyphenolic polymer and polydimethylglutarimide (PMGI), either in admixture (to form release layer 2) or as separate layers (to form adhesion promoter layer 2A and

[1] For the Appellants' polymer to be a phenolic polymer, at least one of the R groups must be a hydroxyl group, or the azo dye must include a phenol group (*see* Spec. 4:12; 9:21-22).

release layer 2) (¶¶ 0043, 0045).[2,3] Breyta applies thereon a photoresist layer (3) and then imagewise exposes and develops the layers such that there is an undercut in the release layer and, if present, the separate adhesion promoter layer (§§ 0043, 0045, 0051).[4] Breyta then deposits a desired material such as a conductive metal using a deposition technique such as evaporation or sputtering, and lifts off the unwanted material (6) (¶¶ 0042-0045).

Whewell discloses a method for producing circuit board fine line patterns (col. 1, ll. 7-10). Whewell teaches that for applying a metal coating layer, electroplating and electrodeposition generally are less expensive and less time consuming than alternative techniques such as sputtering or electroless deposition (col. 5, ll. 35-39; col. 6, ll. 43-47).

The Appellants argue that one of ordinary skill in the art would not have combined Breyta and Whewell because Breyta coats the substrate with a release layer before applying photoresist (§§ 0043, 0045), whereas Whewell's invention "eliminates the need for a pre-treatment of the metallic surfaces prior to the application of the photoresist" (col. 3, ll. 26-28) (Br. 11-12; Reply Br. 3-4).

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[2] Breyta's release layer containing the polymeric adhesive, and Breyta's separate release layer and adhesion promoter layer both correspond to the Appellants' barrier layer (Spec. 17:15-17; 22:6-7).
[3] The Appellants also use their polyphenolic polymer in combination with PMGI (Spec. 8:19-21).
[4] Breyta discloses, in the Background of the Invention section, that "[d]uring the development step, the release layer is undercut from the edges of the resist pattern a desired amount to facilitate the subsequent lift-off step" (§ 0003).

Breyta's disclosure that deposition techniques "such as" evaporation or sputtering are suitable (¶ 0042) would have led one of ordinary skill in the art, through no more than ordinary creativity, to use any deposition technique known to be suitable for applying metal layers in the formation of integrated circuits. *See KSR Int'l. Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1741 (2007) (In making the obviousness determination one "can take account of the inferences and creative steps that a person of ordinary skill in the art would employ"). One such technique is electroplating as disclosed by Whewell (col. 5, ll. 35-39; col. 6, ll. 43-47). The Appellants do not explain, and it is not apparent, why one of ordinary skill in the art would have considered Whewell's teaching (col. 5, ll. 35-39) that electroplating generally requires less expense and time than sputtering (disclosed by Breyta, § 0042) to be applicable only if a photoresist layer on which a metal layer is applied has no barrier layer below it.

The Appellants argue that one of ordinary skill in the art would not have used Whewell's electroplating in Breyta's process because Breyta undercuts the photoresist (¶¶ 0043, 0045), and Whewell teaches that undercutting is undesirable (col. 2, ll. 26-37) (Reply Br. 4-6).

Breyta indicates that the undercutting of the release layer and, if present, the adhesion promoter layer, is desirable and takes place regardless of the technique used to form the metal layer on the photoresist (¶¶ 0003, 0042, 0043, 0045). Hence, Whewell's disclosure that undercutting is undesirable in Whewell's method would not have discouraged one of ordinary skill in the art from using electroplating instead of Breyta's disclosed sputtering (¶¶ 0042-0043) to form Breyta's metal layer.

For the above reasons we are not convinced of reversible error in the rejection of claim 1 or claims 2-8, 13 and 14 that stand or fall therewith.

Rejection of claim 36

Independent claim 36 is similar to claim 1, and also requires that "the barrier layer is present in an effective amount to prevent cracks in the photoresist from transferring through the barrier layer and exposing portions of the substrate."

Hawkins discloses an etching process wherein a chemical masking layer and then a protective layer such as polycrystalline silicon are applied to the frontside and backside of a wafer, and the backside protective layer protects the backside masking layer from crack producing mechanical damage during layer deposition and patterning on the wafer's frontside (col. 3, ll. 14-36).

The Appellants argue that "Hawkins actually uses two underlayers under the photoresist (masking layer and protective layer)" (Br. 15; Reply Br. 10).

That argument is not persuasive because the Appellants' claim 36 does not exclude a second layer under the photoresist.

Also, the Appellants disclose that it is their polyphenolic polymer that prevents the transfer of cracks in the photoresist through the barrier layer (Spec. 19:22 – 20:2). As pointed out above regarding the rejection of claim 1, Breyta's polyphenolic polymer has essentially the same composition as that of the Appellants. For that reason and because the typical thickness of about 200-1000 Å of Breyta's polyphenolic polymer (¶ 0046) is the same as that of the Appellants' polyphenolic polymer

(Spec. 22:7-9), it appears that, like the Appellants' barrier layer comprised of a polyphenolic polymer layer and a PMGI layer (Spec. 22:6-9), Breyta's equivalent layer (adhesion promoter layer 2A plus release layer 2) (¶ 0045) prevents cracks in the photoresist from transferring through the barrier layer and exposing portions of the substrate.

We therefore are not convinced of reversible error in the rejection of claim 36.

Rejection of claims 9-11

Claim 9 requires that the developer does not remove the exposed portion of the barrier layer.

Breyta discloses that the resist layer and the release layer are developed (§§ 0043, 0045), but Breyta does not disclose removal by the developer of the exposed portion of the photoresist but not the exposed portion of the release layer.[5]

The Examiner argues that "Lee teaches that the underlayer remains after the exposure and development, and in col[.] 3, lines 42-56, discloses an underlayer (illustrated as reference 25 of figures 2, and 4) and a top photoresist layer (illustrated as reference 12 of figures 2, and 4), and that after exposure to radiation (radiation treatment) and development (see figure 2) a pattern is formed[,]i.e., underlayer pattern is left behind after radiation and development (see figure 2)" (Ans. 11).

[5] Breyta discloses that "[b]y choosing the dye structure one can tailor both the absorption characteristics and the solubility of the polymer film in both developer and solvents" (¶ 0016), but does not disclose that the polymer film can be insoluble in the developer and solvents.

Lee's layer 25 in Figure 2 is "a material that is highly soluble in at least one etchant and that is patternable through development following selective exposure to radiation" (col. 3, ll. 32-35). The portion of layer 25 in Figure 2 is not the exposed portion as required by the Appellants' claim 9 but, rather, is the unexposed portion that remains after the exposed portion has been removed.

Claims 10 and 11, which depend from claim 9, require that the exposed portion of the barrier layer is removed by, respectively, reactive ion etching and milling.

The Examiner argues that "Lee, in col[.] 3, lines 54-56, and in col[.] 4, lines 10-15, and in figure 4, discloses that the remaining portions of the underlayer (reference 25 of figure 2 is subjected to etching to form the result illustrated in figure 4, i.e., removing the underlayer from beneath the top layer) is [sic] removed using an etching process and that the etching methods employed includes [sic] RIE (reactive ion etching) or milling" (Ans. 12).

Lee discloses that photoresist 12 is effective even though it is not in contact with the substrate (due to layer 25 being between it and the substrate) if etching occurs only in a direction normal, or near normal, to the substrate surface (col. 4, ll. 9-13). Exemplified etching methods which satisfy that condition are reactive ion etching and ion beam milling (col. 4, ll. 13-15). The reactive ion etching or ion beam milling does not remove exposed portions of layer 25 that have not been removed by a developer as required by the Appellants' claims 10 and 11 but, rather, forms a pattern by removing both photoresist layer 12 and layer 25.

Hence, the Examiner has not established a prima facie case of obviousness of the inventions claimed in the Appellants' claims 9-11.

Rejection of claim 12

Claim 12, which depends from claim 1, requires that "removal of the exposed portion of the barrier layer does not create undercuts under the photoresist."

The Examiner argues that "Pinarbasi, in col[.] 6, lines 38-54, and in figures 10 and 11, discloses the etch process to remove the exposed portions of the barrier layer (release layer), and illustrates the exposure of the release layer (exposed portions only) to e-beams (e-beams etch portions that are exposed) without causing an undercut portion in the release layer" (Ans. 12).

A comparison of Pinarbasi's Figures 11 and 12 shows that removal of the exposed portion of release layer 306 forms an undercut under the photoresist. Thus, the Examiner has not provided evidence of an exposed portion of a barrier layer below a photoresist layer being removed without creating undercuts under the photoresist.

The Examiner, therefore, has not established a prima facie case of obviousness of the invention claimed in the Appellants' claim 12.

DECISION

The rejections under 35 U.S.C. § 103 of claims 1-8, 13, and 14 over Breyta in view of Whewell, and claim 36 over Breyta in view of Whewell and Hawkins are affirmed. The rejections under 35 U.S.C. § 103 of claims 9-11 over Breyta in view of Whewell and Lee, and claim 12 over Breyta in view of Whewell and Pinarbasi are reversed.

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

AFFIRMED-IN-PART

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