UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte YAN YE, JOHN WHITE, AKIHIRO HOSOKAWA,
and HIENMINH H. LE

Appeal 2009-001919
Application 11/225,923
Technology Center 1700

Decided: December 31, 2009

Before KAREN M. HASTINGS, MICHAEL P. COLAIANNI, and
JEFFREY B. ROBERTSON, *Administrative Patent Judges*.

COLAIANNI, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134 the final rejection of claims 3, 6, 12, 18, and 19. We have jurisdiction over the appeal pursuant to 35 U.S.C. § 6(b).

We AFFIRM.

Appellants describe a method of processing a substrate in a PVD (Physical Vapor Deposition) chamber having a sputtering target with separately biasable sections, regions, or zones to improve the deposition uniformity (Spec. 9).

Claims 3, 6, and 18 are illustrative:

3. A method of depositing a thin film on a large area substrate, comprising:

electrically biasing a first target section of a multizone target assembly at a first bias using a first power supply;

electrically biasing a second target section of the multizone target assembly at a second bias using a second power supply, wherein the first target section is positioned closer to a center of the multizone target assembly than the second target section;

controlling the deposition profile received on a substrate surface that is in communication with a processing region by controlling the bias delivered by the first power supply and the second power supply;

evacuating the processing region that is in communication with a processing side of the multizone target assembly to a first pressure;

evacuating a backside region that is in communication with a side of the multizone target assembly that is opposite to the processing side to a second pressure to provide a desirable deflection of the multizone target assembly;

adjusting the magnitude of the first bias as a function of time, wherein the magnitude of first bias at a first time is equal to X; and

adjusting the magnitude of the second bias as a function of time, wherein the magnitude of second bias at the first time is equal to Z, and wherein the magnitude of X is greater than Z.

6. A method of depositing a thin film on a large area substrate, comprising:

electrically biasing a first target section of a multizone target assembly at a first bias using a first power supply;

electrically biasing a second target section of the multizone target assembly at a second bias using a second power supply;

controlling the deposition profile received on a substrate surface that is in communication with a processing region by controlling the bias delivered by the first power supply and the second power supply;

evacuating the processing region that is in communication with a processing side of the multizone target assembly to a first pressure;

evacuating a backside region that is in communication with a side of the multizone target assembly that is opposite to the processing side to a second pressure to provide a desirable deflection of the multizone target assembly; and

providing a process gas to the processing region through a port formed in the first target section or the second target section.

18. A method of depositing a thin film on a substrate, comprising:

positioning a first magnetron assembly that has a first average magnetic field strength over a surface of a first target section;

positioning a second magnetron assembly that has a second average magnetic field strength over a surface of a second target section, wherein the first target section is positioned closer to a center of the multizone target assembly than the second target section;

electrically biasing the first target section at a first bias using a first power supply;

electrically biasing the second target section at a second bias using a second power supply;

translating the first magnetron assembly parallel to the surface of the first target section and the second magnetron assembly parallel to the surface of the second target section using an actuator assembly; and

controlling the deposition profile received on a substrate surface by controlling the first bias delivered by the first power supply, the second bias delivered by the second power supply, and the translation of the first and second magnetron assemblies so that the time average of the magnetic field strength across the surface of the first target section is greater then zero and the time average of the magnetic field strength across the surface of the second target section is greater then zero, wherein the second average magnetic field strength is less than the first magnetic field strength.

The Examiner relies on the following prior art reference as evidence of unpatentability:

Bergmann	4,275,126	Jun. 23, 1981
Kubo	5,334,302	Aug. 2, 1994
Demaray	5,565,071	Oct. 15, 1996
Haag	US 6,284,106 B1	Sep. 4, 2001
Sato	US 2004/0231973 A1	Nov. 25, 2004

The rejections provided by the Examiner are as follows:

1. Claims 3 and 6 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Haag in view of Demaray.
2. Claim 12 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Haag in view of Sato and Demaray.
3. Claims 18 and 19 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Sato in view of Haag and Bergmann.
4. Claim 6 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Haag in view of Kubo and Demaray.
5. Claim 12 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Haag in view of Sato, Demaray, and Kubo.

Regarding rejections (1), (2), (4), and (5), Appellants argue claim 3 and claims 6 and 12.

Regarding rejection (3), Appellants argue claim 18. Accordingly, the rejection of claim 19 stands or falls therewith.

REJECTION (1): § 103(a) over Haag in view Demaray

Claim 3

ISSUE

Have Appellants shown that the Examiner reversibly erred in determining that the claimed feature of providing a greater bias to a first target closer to the center of the target assembly than the bias applied to a target farther from the center of the target assembly would have been obvious in light of Haag's disclosure to optimize the sputtering rate and deposition profile by controlling the specific location and distribution of the electrical supply to the individual targets? We decide this issue in the negative.

PRINCIPLES OF LAW

It would have been obvious for an artisan with ordinary skill to develop workable or even optimum ranges for art-recognized, result-effective parameters. *In re Woodruff*, 919 F.2d 1575, 1578 (Fed. Cir. 1990); *In re Boesch*, 617 F.2d 272, 276 (CCPA 1980); *In re Aller*, 220 F.2d 454, 456 (CCPA 1955).

The obvious analysis "need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007).

FACTUAL FINDINGS (FF)

1. Appellants do not contest that Haag discloses optimizing the location and time distribution of the sputtering rate by controlling the electrical supply or magnetic field on the target arrangements (App. Br. 12). Appellants do not contest the Examiner's reason for combining Haag and Demaray (App. Br. *generally*).
2. Haag discloses that "preferably" the sputter coating system is operated such that the two outer targets arrangements are operated with more power than the inner target arrangement (col. 5, ll. 40-45). The Examiner finds this disclosure as not limited to such a preferred target operation, but includes operating in the reverse as long as film thickness distribution and homogeneity are controlled (Ans. 16).

ANALYSIS

Appellants argue that Haag's disclosure to optimize the sputtering rate by controlling, *inter alia*, the time distribution and location of the electrical supply of the target arrangement, fails to suggest or teach biasing the target closer to the center with a higher bias than the target at the edge (Br. 12). Appellants argue that the Examiner engaged in impermissible hindsight to meet the disputed claim feature (Br. 12).

Appellants' arguments are unpersuasive because they narrowly focus on the failure of the prior art to disclose the disputed feature while not appreciating the inferences and creative steps that a person of ordinary skill in the art would have employed. *KSR*, 550 U.S. at 418.

Specifically, Haag undisputedly teaches that the location and time distribution of the electrical supply to the targets may be optimized to control the deposition. In other words, the biasing location and time distribution of the bias are result-effective variables such that it would have been obvious to one of ordinary skill in the art to optimize the bias time and location distribution of the targets to achieve a desired deposition profile. *Boesch*, 617 F.2d at 276. The Examiner correctly finds this disclosure may include operating the center target at a higher bias than the outer, second target so as to control the film thickness distribution and homogeneity (i.e., to optimize the deposition profile) (FF 2).

Therefore, contrary to Appellants' argument, the Examiner's prima facie case is based on the teachings of the references and what these teachings would have suggested to one of ordinary skill in the art, not impermissible hindsight.

For the above reasons, we find Appellants' arguments to be without persuasive merit. We affirm the Examiner's § 103(a) rejection of claim 3 over Haag in view of Demaray.

Rejections (1), (2), (4), and (5)
Claims 6 and 12

ISSUE

Have Appellants shown that the Examiner reversibly erred in finding that Haag teaches the step of providing a processing gas to the processing region through a port formed in the first target section or the second target section as required by claims 6 and 12? We decide this issue in the affirmative for rejections (1) and (2), and in the negative for rejections (4) and (5).

FINDINGS OF FACT

3. Claims 6 and 12 state providing process gas "through a port *formed in* the first target section or the second target section."
4. The Specification differentiates between forming a port between target sections (Fig. 7A) and through target sections (Fig. 7C) (Spec. ¶¶ [0079] and [0080]). The port is formed through the target sections by forming a through hole in the target sections themselves (Fig. 7C), rather than positioning the port between two distinct target sections as in Appellants' 7B embodiment.
5. The Specification refers to the target sections as being elements 127A and 127B in the figures (*See e.g.*, Spec. ¶¶ [0067]-[0071], [0079] and [0080]). Elements 127A and 127B are described as being made of a single piece of target material or multiple plates that are electrically bonded or connected to one another (Spec. ¶¶ [0067] and [0068]).
6. In rejections (1) and (2), the Examiner finds that Haag teaches providing a processing gas to a process region through a port formed in a gap between the first and second target sections, or in the first or second target sections (Ans. 4). The Examiner

interprets "target sections" as "areas where targets are located" (Ans. 16). Using this interpretation, the Examiner finds that Haag's target sections are bounded by anodes 39 such that the ports 49 are formed in target sections (Ans. 16).

7. Haag discloses that the gas inlet openings (i.e., ports) 49 are formed "along the longitudinal sides of the target arrangements" (col. 9, ll. 16-18). Haag's Figure 4 shows that the gas inlets 49 are formed in and through the base 41 on both sides of the anode 39 and between targets (3a1, 3b1) (Fig. 4).
8. Regarding rejections (4) and (5), the Examiner finds that under an alternative interpretation where "target sections" include target plates, Haag fails to teach providing process gas to a process region through a port formed in the first target section or the second target section (Ans. 11, 13). The Examiner finds that Kubo teaches supplying a gas through a port formed in a target section to control the flow of sputter particles (Ans. 11-12, 15).
9. Based the findings noted in FF 8, the Examiner concludes that it would have been obvious to one of ordinary skill in the art to modify Haag to supply gas through a port formed in a target to control the flow of sputter particles (Ans. 12 and 15).

PRINCIPLE OF LAW

The applicant bears the procedural burden of showing error in the Examiner's rejections. *See, e.g., In re Kahn*, 441 F.3d 977, 985-86 (Fed. Cir. 2006) ("On appeal to the Board, an applicant can overcome a rejection

[under § 103] by showing insufficient evidence of *prima facie* obviousness”) (citation and internal quote omitted).

ANALYSIS

Appellants argue that Haag does not teach providing a processing gas to the processing region through a port formed in the first target section or the second target section (App. Br. 13; 15). Appellants contend that Haag’s gas inlets 49 are between target sections, and are not formed in the target sections (App. Br. 13-15).

With regard to rejections (1) (claim 6) and (2), the Examiner construes “target sections” as meaning “areas where targets are located.” Based on this broad interpretation, the Examiner determines that Haag’s gas inlets 49 are “formed in” an area where the targets are located. We begin our analysis by determining if the Examiner’s broad construction of “target sections”, as applied in rejections (1) and (2), is reasonable in light of the Specification.

The Specification describes “target sections” as elements that comprise the target (i.e., the target material itself). The Specification does not describe “target sections” as merely referring to the area where the targets are located. Accordingly, we determine that the Examiner’s construction of “target sections” is unreasonably broad in light of the Specification disclosure. We properly construe “target sections” as meaning the elements that comprise the target.

The Specification further differentiates between the Figure 7A embodiment where the ports are formed between targets and the Figure 7C embodiment where the ports are formed in the targets. Therefore, we construe the claim phrase “a port formed in the first target section or the

second target section" as requiring the port be formed through the target, such as a hole extending through the target.

While the Examiner cites to column 9, lines 16-24 of Haag in rejections (1) (claim 6) and (2) as showing a port formed in the first target section or second target section (Ans. 4), the Examiner admits that the finding is based on the unreasonably broad construction of "target sections" as areas where the targets are located (Ans. 9-10). Indeed, Haag discloses that the gas inlets 49 are formed between and along the longitudinal edge of the target sections, not formed in the target sections.

Therefore, we reverse the Examiner's § 103 rejections of claim 6 over Haag in view of Demaray and claim 12 over Haag in view of Sato and Demaray.

With regard to rejections (4) and (5), Appellants argue that introducing gas through the sputtering target causes a change in the plasma within the chamber such that modifying Haag to supply gas through the target would alter the directional components of the particles and affect the uniformity of the deposition (Reply Br. 3). Appellants contend that modifying Haag's target with Kubo's gas port through the target is based upon impermissible hindsight (Reply Br. 3). Appellants argue that the Examiner as not provided any articulated reasoning with rational underpinning to support the combination of Haag and Kubo (Reply Br. 3).

Contrary to Appellants' arguments, the Examiner provided a reason for modifying Haag's target to include Kubo's gas port: to provide Haag with better directional control of the deposited material and deposited a coating with greater uniformity as taught by Kubo (Ans. 11-12 and 15).

Therefore, the Examiner's reason for combining the references is based on the teachings of the references and not impermissible hindsight.

While Appellants are correct that the greater directional control is needed in Kubo in order to fill the contact hole 52 in the wafer W (Fig. 4), Kubo discloses that the wafer may be moved relative to the target to form a thin film with a higher uniformity (col. 8, ll. 5-27). Moreover, Kubo discloses that substrates other than wafers may be coated with the sputtering device including LCD displays (col. 11, ll. 25-29); Haag likewise coats display substrates. Therefore, Appellants' arguments regarding Kubo's deposition affecting Haag's homogeneous and uniform deposition are without persuasive merit.

For the above reasons, we affirm the Examiner's § 103 rejections of claim 6 over Haag in view of Kubo and Demaray, and claim 12 over Haag in view of Sato, Kubo, and Demaray.

Rejection (3): Sato in view of Haag and Bergmann

ISSUE

Have Appellants shown that the Examiner reversibly erred in finding that Sato in view of Haag and Bergmann would have suggested a method of depositing a thin film on a substrate wherein the average magnetic field strength of the magnetron positioned over a target section closer to a center of a multizone target assembly is higher than the average magnetic field strength of the magnetron positioned over a target section farther from the center of the multizone target assembly as required by claim 18? We decide this issue in the negative.

PRINCIPLES OF LAW

We rely on the principles of law noted earlier in this decision.

FACTUAL FINDINGS

10. Appellants do not dispute any of the Examiner's findings regarding Sato, Haag or Bergmann (App. Br. 17-19; Reply Br. 6).

11. The Examiner finds that Bergmann teaches varying the magnetic field using electromagnets at different target regions, which suggests controlling the magnetic field strength to be more or less in areas of the targets (Ans. 9). The Examiner also finds that Bergman uses rheostats to control the magnetic field to be more or less in areas of the separate targets (Ans. 18-19). Appellants do not dispute these findings.

ANALYSIS

Appellants argue that Sato, Haag, and Bergman fail to teach or suggest a method of depositing a thin film on substrate wherein the average magnetic field strength of the magnetron positioned over a target section closer to a center of a multizone target assembly is higher than the average magnetic field strength of the magnetron positioned over a target section farther from the center of the multizone target assembly as required by claim 18 (App. Br. 17). Appellants contend that Bergmann discloses merely moving a magnetron behind a single target, and does not or suggest the disputed feature (App. Br. 17; Reply Br. 6).

The Examiner finds that Bergmann's teaching to control the magnetic field among the various areas of target with rheostats would have suggested controlling magnetic field so that the average magnetic field is greater at the center of the target than at the sides of the target as claimed. Appellants never address this finding of the Examiner. Instead, Appellants argue that Bergmann merely moves a magnet behind a substrate, which fails to teach or suggest the disputed feature.

Therefore, Appellants have not shown reversible error in the Examiner's stated prima facie case. We affirm the Examiner's § 103 rejection of claims 18 and 19 over Sato in view of Haag and Bergmann.

DECISION

The Examiner's § 103 rejection of claim 3 over Haag in view of Demaray is affirmed.

The Examiner's § 103 rejection of claim 6 over Haag in view of Demaray is reversed.

The Examiner's § 103 rejection of claim 12 over Haag in view of Demaray and Sato is reversed.

The Examiner's § 103 rejection of claim 6 over Haag in view of Kubo and Demaray is affirmed.

The Examiner's § 103 rejection of claim 12 over Haag in view of Kubo, Sato, and Demaray is affirmed.

The Examiner's § 103 rejection of claims 18 and 19 over Sato in view of Haag and Bergmann is affirmed.

The Examiner's decision is affirmed.

ORDER

AFFIRMED

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sld

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