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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte HIROYUKI ORITA, AKIO YOSHIDA, MASAHISA KOGURA,
TAKAHIRO SHIRAHATA, and SYUJI TANAKA

Appeal 2017-004912
Application 13/059,128¹
Technology Center 1700

Before LINDA M. GAUDETTE, CHRISTOPHER C. KENNEDY, and
SHELDON M. McGEE, *Administrative Patent Judges*.

McGEE, *Administrative Patent Judge*.

DECISION ON APPEAL

Pursuant to 35 U.S.C. § 134(a), Appellants seek our review of the Examiner's rejections adverse to the patentability of claims 1, 3, 6, 7, 10, 12, 14, 16, 17, 21, 23, 25–27, 29, and 31 under 35 U.S.C. § 103(a).

We have jurisdiction under 35 U.S.C. § 6.

We affirm.

¹ Appellants identify the real party in interest as Toshiba Mitsubishi-Electric Industrial Systems Corporation. App. Br. 1.

SUBJECT MATTER

The subject matter on appeal relates to methods of forming a metal oxide film on a substrate. Such metal oxide films may be used in devices such as solar batteries and touch panels. Spec. ¶ 2.

Claim 1 is illustrative, and is copied below with the key limitation at issue in this appeal italicized:

1. A method of forming a metal oxide film, the method comprising:

(A) converting a solution comprising at least one of Ti, Zn, In, and Sn into a mist by applying ultrasonic waves to said solution, present in a solution container;

(B) heating a substrate to a temperature sufficient to form a metal oxide film by heating a heating device in contact with said substrate to a[sic.] the sufficient temperature, thereby obtaining a heated substrate, said substrate present in a reaction vessel; and

(C) supplying the mist from (A) through a path that connects the solution container to the reaction vessel, thereby applying the mist to a first main surface of the substrate from (B) and supplying ozone to the reaction vessel, thereby applying the ozone to a first main surface of the heated substrate from (B), thereby forming at least one of a TiO₂ film, a ZnO film, an In₂O₃ film, a SnO film and a SnO₂ film on the first main surface of the heated substrate,

wherein the supplying (C) of the mist and of the ozone is carried out separately and at predetermined timings, and

wherein neither the solution nor the ozone is contacted with ultraviolet rays during the method.

App. Br. 12² (emphasis added).

² Because the Appeal Brief does not contain page numbers, our opinion refers to the sequential order of pages.

REFERENCES

The Examiner relies on the following references as evidence of unpatentability:

Gordon	US 5,980,983	Nov. 9, 1999
Satoh	US 6,235,112 B1	May 22, 2001
Nikolov	US 2005/0180014 A1	Aug. 18, 2005

REJECTIONS

The following claims are rejected under 35 U.S.C. § 103(a):

- I. Claims 1, 3, 10, 16, 17, 25, 29, and 31³ over Satoh and Nikolov;
and
- II. Claims 6, 7, 12, 14, 21, 23, 26, and 27 over Satoh, Nikolov, and Gordon.

STATEMENT OF THE CASE

The Examiner finds that Satoh teaches the method of forming a metal oxide film according to independent claim 1, except for the limitation requiring that the mist generated in step (A) and the ozone are supplied to the reaction vessel “separately and at predetermined timings.” Final Act. 2—3. The Examiner finds that Nikolov teaches a method of forming metal oxide films where vapors of a metal containing (e.g., titanium) precursor solution are first introduced into a reaction chamber and adsorbed onto a substrate, followed by the introduction of a reactant (e.g., ozone) into the

³ The rejection heading (Final Act. 2) erroneously omits claim 31, but the body of the rejection (*id.* at 5) sets forth the grounds of rejection for this claim. Thus, we treat the omission of claim 31 from the rejection heading as a harmless typographical error.

chamber. *Id.* According to the Examiner, Nikolov teaches that the separate dosing of metal-containing precursor and reagent “allows for the deposition of highly uniform layers.” *Id.* Based on this disclosure, the Examiner concludes that it would have been obvious to the skilled artisan to modify the teachings of Satoh to supply the metal-containing mist and the ozone into the reaction chamber separately in order to yield a highly uniform deposition of layers on the substrate. *Id.* The Examiner makes similar findings and conclusions with respect to claim 3, the only other independent claim on appeal. *Id.* at 3–4.

OPINION

Rejection I

Appellants argue the claims subject to Rejection I as a group.⁴ App. Br. 5–9. Therefore, we select claim 1 as representative, and decide the appeal as to this ground of rejection on the basis of claim 1. 37 C.F.R. § 41.37(c)(1)(iv).

Appellants contend that the Examiner’s proposed modification of Satoh is improper because Satoh introduces the metal- or metalloid-containing reactants into the reaction chamber as a liquid, while Nikolov requires such reactants to be introduced in gaseous form. App. Br. 5–7. Appellants contend further that Satoh requires the metal- or metalloid-containing reactant and the oxidant to be “simultaneously present” in the reaction chamber in order to form the metal oxide film, whereas Nikolov

⁴ Although the Appeal Brief Argument subheading refers to “Separately argued claims 1 and 3,” no separate arguments appear to be made with respect to claim 3.

requires the sequential introduction of the reactant and oxidant. *Id.* at 6. Appellants characterize Satoh's process as chemical vapor deposition (CVD), and Nikolov's process as atomic layer deposition (ALD). *Id.* Based on the alleged differences in these respective processes, Appellants contend there would have been no reason to modify Satoh with Nikolov (*id.* at 7), and that the Examiner's proposed modification would render Satoh's process unsatisfactory for its intended purpose (*id.* at 7–8). Appellants contend further that they have “demonstrated a particular benefit to the claimed introduction of the reactants at separate and at predetermined timings.” *Id.* at 8–9.

Appellants' arguments fail to persuade us of reversible error in the Examiner's rejection of claim 1. We, therefore, sustain Rejection I.

Our analysis begins by noting several of Appellants' arguments are based on a misunderstanding of the teachings of Satoh. Contrary to Appellants' argument (App. Br. 5–7), Satoh does not require the metal-containing reactant to reach the substrate in liquid form. Rather, Satoh expressly teaches that “the mist is vaporized at the surface of the substrate *or prior to* reaching the surface of the substrate,” Satoh 2:44–46 (emphasis added). *See also id.* at 3:34–36, 5:40–43. We also observe that Satoh does not even require the presence of ozone for the metal-containing reactant to form a thin film on a substrate, much less its simultaneous presence in the reaction chamber with the metal-containing reactant. Satoh 2:36–44 (explaining how a thin film is formed on the substrate after the mist of the liquid reaction material (which includes e.g., “metal organic compounds,” *id.* at 4:20–24) is advanced toward a surface of the substrate and is vaporized either at, or prior to, the substrate surface). Rather, Satoh merely expresses a preference for “supplying a reaction material gas [e.g., ozone (*id.* at 4:26–

29)] being reactive with the liquid reaction material to form the thin film on the surface of the substrate.” *Id.* at 2:47–50. Sato’s preference, as opposed to a requirement, for using a reaction material gas is reflected in various embodiments. *Compare* Satoh, Figs. 1, 2 (no source of reaction material gas), *with id.*, Figs. 3, 4 (source of ozone-containing oxygen gas 30 delivered into the reaction chamber through intake port 29 via mass flow controller 11” and valves 16f”, 16g’, and 16e’).

Based on the above disclosure, we cannot agree with Appellants that the skilled artisan would not have been motivated to modify the teachings of Satoh to separately introduce the liquid reaction material and reaction material gas, should such gas even be used. Indeed, the Examiner has provided a sound reason to do so, based on the teachings of Nikolov (Final Act. 3), and the device of Satoh is capable of separately introducing these constituents. Here, we emphasize Satoh’s express teaching that the “oxygen gas introduced from the port 30 is also controlled at a given flow rate by the mass flow controller 11” and is then introduced into the interior of the reaction chamber 1’ from the intake port 29 via the valves 16f”, 16g’, and 16e’.” Satoh 6:11–15. Because Satoh’s reaction material gas is delivered into the reaction chamber through a separate controller, intake port, and valves than is the metal-containing liquid reaction material, the skilled artisan would have recognized that these separate constituents could separately be supplied into the reaction chamber. Based on the teachings contained in Nikolov that such separate dosing of elements on a substrate yields layers that are “highly uniform” (Nikolov ¶ 47), the skilled artisan would have recognized that Satoh’s thin films could be improved using the same technique. “[I]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve

similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007). Appellants have provided no evidence that the Examiner’s proffered modification would be beyond the skill of the ordinary artisan. Thus, we discern no error in the Examiner’s conclusion of obviousness.

Turning to Appellants’ contention regarding certain benefits, we share the Examiner’s view (Ans. 11–12) that the experimental data is not commensurate in scope with the claimed subject matter. Specifically, it is unclear whether the metal oxide film in the experimental sample is a “TiO₂ film, a ZnO film, an In₂O₃ film, or a SnO film” as required by claim 1. Even if the film was shown to be one of the four recited films, Appellants have not shown how any properties of such film can reasonably be extended to the other three that are encompassed by claim 1.

We also note that Appellants do not assert that the purported benefits are unexpected. “[T]he burden of showing unexpected results rests on he who asserts them. Thus it is not enough to show that results are obtained which differ from those obtained in the prior art: that difference must be shown to be an *unexpected* difference.” *In re Klosak*, 455 F.2d 1077, 1080 (CCPA 1972).

Thus, we sustain Rejection I.

Rejection II

Appellants present arguments germane to the limitations recited in claims 7 and 23, which each require the conversion of “two or more different solutions into a mist,” and then supplying the mist “simultaneously or separately.” App. Br. 10.

Appellants' arguments are unpersuasive for the reasons provided by the Examiner in the Answer. Ans. 12–13. Furthermore, we emphasize that Appellants do not address, and thus do not reveal error in, the Examiner's reliance on the well-established doctrine regarding a mere duplication of steps as set forth in *In re Harza*, 274 F.2d 669 (CCPA 1960). Here, we agree with the Examiner's determination (Final Act. 6) that the recited conversion of "two or more different solutions into a mist" constitutes a duplication of a step performed in claim 1, and shifts the burden to Appellants to demonstrate some new, unexpected result. *In re Harza*, 274 F.2d at 671. No such unexpected results have been provided. We also observe that Appellants' criticality argument (App. Br. 10) is misplaced because paragraph 70 of the Specification discusses the separate supply of the metal-containing mist (i.e., "solution 4" (Spec. ¶ 60)) and *the ozone*, not the separate supply of multiple metal-containing mists to the substrate.

For these reasons, we sustain Rejection II.

DECISION/ORDER

The Examiner's final decision to reject claims 1, 3, 6, 7, 10, 12, 14, 16, 17, 21, 23, 25–27, 29, and 31 is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1).

AFFIRMED