Paper 22

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

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Ex parte YUN-HO JUNG

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Appeal 2001-0107
Application 09/143,505[1]

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ON BRIEF[2]

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Before: GARRIS, PAWLIKOWSKI, and NAGUMO, Administrative Patent Judges.

NAGUMO, Administrative Patent Judge.

Decision on appeal under 35 U.S.C. § 134

The appeal is from a decision of a primary examiner rejecting claims 1 through 4, 6 through 14, and 16 through 36, all the claims remaining in the application. We reverse.

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[1] Application for patent filed August 28, 1998. Appellant claims the benefit of priority under 35 U.S.C. § 119 based on Korean Application P97-44218, filed August 30, 1997. According to Appellant, the real party in interest is LG Philips LCD Inc. Ltd. (Brief at 1.)

[2] Appellant requested a hearing (Paper No. 18, filed July 14, 2000), but subsequently waived the hearing (Paper No. 21, filed May 16, 2002).

1. Findings of fact

The record supports the following findings by at least a preponderance of the evidence.[3]

The invention

The invention relates to a laser annealing system useful for forming a polycrystalline silicon film from an amorphous silicon film. (Specification at 1, ll. 5-13.)

According to Appellant, in the prior art, such a system comprised a vacuum chamber fitted with a quartz chamber window and a substrate mount. (*Id.* at 1, l. 23 to 2, l. 8.) The substrate would be irradiated by a laser beam passing through the chamber window, which would heat the substrate sufficiently to cause annealing. (*Id.* at 3, ll. 2-8.) Appellant discloses that it is known to pattern the substrate with variously shaped annealed regions. (*Id.* at 2, l. 9, to 3, l. 1.) When the energy density of the laser beam is "excessivly larger than is necessary for the thickness of the film," some of the amorphous film may be vaporized, along with vaporizable contaminants on the surface of the film. (*Id.* at ll. 8-12.) Appellant states that such vaporized contaminants are deposited on the inside of the

[3] To the extent these findings of fact discuss legal issues, they may be treated as conclusions of law.

chamber window, which interferes with the laser beam. (*Id.* at ll. 13–19.) The laser beam must be repositioned and re-sized, and the contaminated windows must be cleaned, causing delays and lowering the process yield. (*Id.* at ll. 20–29.)

Appellant teaches that the window contamination and associated problems are overcome in a system in which a "buffer window" is interposed between the window and the substrate overcomes. (*Id.* at 4, ll. 1–9.) Appellant explains that "[e]ventually, the evaporated contaminants and the partial components of the film are deposited in the under surface of the buffer window 34 instead of the chamber window 33. Thus, it is impossible for the contaminants to reach the chamber window 33 because the buffer window 34 is in the way of the contaminants." (*Id.* at 9, ll. 5–11, referring to Figure 3.) Because the buffer window and support are entirely within the chamber, there is no pressure difference across the buffer window, and it may be made much thinner than the chamber window. (*Id.* at ll.28–30.) The buffer window is easily replaced, and is much cheaper than a new chamber window because it is much thinner. Moreover, the buffer window may be patterned with a cutoff layer, permitting annealed patterns to be formed on the substrate upon exposure to the laser

beam. (*Id.* at 8, ll.9-18.) Other relevant features of the invention are readily discerned from the claims.

The claims

The following claims are representative:

1. An annealing system for annealing a target material with a radiation source, the annealing system comprising:

a window for passing the radiation source therethrough;

a process region aligned with the window and disposed in a path of the radiation source to receive the radiation source, the process region containing the target material being annealed; and

a buffer layer aligned with the window and the process chamber and formed in the path of the radiation source, wherein the annealing produces a byproduct containing contaminants, and the buffer layer formed between the window and the process region substantially blocks the byproduct from reaching the window.

7. An annealing system of claim 1, wherein the buffer layer is made of quartz.

8. An annealing system of claim 1, wherein the buffer layer is mounted on a support frame placed between the window and the target material to block the byproduct from reaching the window.

9. An annealing system of claim 1, wherein the buffer layer has an anti-reflective layer.

34. The annealing system of claim 1, wherein the byproduct includes vaporized contaminants and wherein the buffer means substantially prevents the vaporized contaminants from being deposited on the window.

The examiner's rejections

Claims 1–4, 6–14, and 16–36 are rejected as obvious under 35 U.S.C. § 103(a) over the combined teachings of Noguchi[4] and Kondo[5].

Noguchi

Noguchi teaches an surface-treatment apparatus that provides for, *inter alia*, laser annealing of silicon substrates using a single shot of laser light. (Noguchi at col. 2, l. 66 to col. 3, l. 4.) Noguchi describes a system similar to that claimed by Appellant, except that Noguchi's system lacks an element that corresponds to Appellant's "buffer layer." More specifically, with reference to Figure 3, Noguchi describes a chamber **15** having a window **41** through which the laser light **21** passes on its way to striking a workpiece **91**. (*Id.* at col. 9, ll. 17–34.) The window **41** may be made of quartz. (*Id.* at ll. 34–35.) The chamber is provided with means to provide various atmospheres for the workpiece, including a vacuum. (*Id.* at ll. 54–58.) Moreover, Noguchi teaches that the workpiece may be patterned by placing a

[4] U.S. Patent No. 5,869,803, issued to Takashi Noguchi et al. on February 9, 1999, which is a continuation of an application filed November 1, 1994.

[5] U.S. Patent 5,322,538, issued to Nobuhiro Kondo and Hirokazu Ono on June 21, 1994.

reticle in the optical path external to the workpiece chamber. (*Id.* at col. 10, ll. 12–26.) As for lasers, Noguchi teaches that excimer lasers, including xenon chloride lasers, are suitable. (*Id.* at col. 8, ll. 4–7.) According to Noguchi, a principal object of the invention is to treat a large area, greater than about 10 cm^2 by a single shot. (*Id.* at col. 3, ll. 2–4, and 14–17.) Single-shot annealing of 6×6 cm^2 areas are reported, e.g., in Example 1. (*Id.* at col. 19, ll. 30–40.)

Kondo

Kondo relates to a process of patterning photosensitive glass by patterned exposure to light followed by etching. More particularly, Kondo teaches a method that facilitates control over the etch depth, minimization of surface roughness, and, particularly for single-sided etching, a way to eliminate the need to attach protective tape to one side of the photosensitive glass. (Kondo at col. 2, ll. 5–22.) With reference to Figure 1, Kondo teaches that a photosensitive glass **10** is exposed to laser light through an exposure mask **2**, which is patterned with shaded areas **2b** that block the laser light from the glass surface. (Kondo at col. 4, ll. 34–45.) After further laser exposure to define layer depths (*id.* at l. 61 to col. 5, l. 6), the glass is

heated to form crystallized regions in the exposed areas (*id.* at col. 5, ll. 19–24), which are subsequently etched away in hydrofluoric acid (*id.* at ll. 25–32). A single sided etching process is illustrated in Figures 12–14, and described in Embodiment 4, at columns 7–9.

The examiner's rationale

The examiner maintains, in essence, that Noguchi teaches every limitation of claim 1 but for the placement of a buffer layer between the amorphous silica target and the quartz window. (Examiner's Answer at 3–4.) To remedy this deficiency, the examiner relies on Kondo, which, the examiner urges, teaches the use of an exposure mask in "similar arrangements and methods of annealing photosensitive glass (which crystallizes in response to laser radiation)". (*Id.* at 4, ll. 1–4, citing Kondo, col. 4, ll. 30–60, and Figure 1.) The examiner explains that it would have been obvious to place the exposure mask taught by Kondo directly above the target in Noguchi because Kondo teaches that "it would have facilitated differential exposure of a photosensitive glass to laser radiation." (Examiner's Answer at 4, ll. 4–8.) The examiner argues that positioning the exposure mask and the necessary mounting means directly above the target would necessarily shield the chamber window from any

material ejected from the target. (*Id.* at ll. 9-13.) Thus, the subject matter of claims 1, 8, and 34 would have been obvious.

Although the examiner concedes that neither Noguchi nor Kondo teaches that the exposure mask could be made from quartz, the examiner notes that the Noguchi apparatus already contains a quartz chamber window. The examiner concludes that the known properties (durability, transparency, stability) would have rendered the use of quartz (as required by claim 7) obvious. (*Id.* at ll. 14-19.)

As for the antireflective layer required by claim 9, which the examiner concedes is not taught by Noguchi or Kondo, the examiner maintains that it would have been obvious to provide such a coating on the window to minimize "reflected laser radiation trapped between the exposure mask and the treated glass or reflecting from the inside chamber surfaces." Such reflected radiation, the examiner asserts, would have "compromised the precision of the exposure pattern on the glass." (Examiner's Answer at 5, ll. 2-5.)

Appellant's argument

Appellant does not dispute that Noguchi discloses every limitation of the claimed invention but for the presence of a buffer layer (and the associated properties). (Brief at 7.) Nor

does Appellant dispute that Kondo teaches the use of an exposure mask in the exposure of a photosensitive glass. (*Id.* at 7–8.) Appellant maintains, however, that Kondo does not disclose any of the limitations required by the claims. (*Id.* at 8.) Appellant urges that the examiner has failed to show any teaching or motivation in these references as to where or how to position Kondo's mask in relation to Noguchi's substrate, or how such a combination would operate. (*Id.* at 9.) Moreover, Appellant urges that Noguchi teaches a scanning system, and that therefore the mask need not cover the entire substrate, but could be relatively small, demonstrating the failure of the examiner's reliance on inherency. (Brief at 11.)

Appellant also argues that the examiner's theory of inherency is flawed because there is no showing that the claimed system would necessarily substantially block annealing byproducts from reaching the chamber window. (*Id.* at 9–10.) Specifically, Appellant urges that the examiner has assumed incorrectly that the byproducts travel in a straight line, whereas vaporized byproducts need not do so. (*Id.* at 10.) Therefore, argues Appellant, "merely placing a mask somewhere 'directly above' a [sic] amorphous silicon surface would not *inherently* - block such contaminants from reaching the window." (*Id.*, emphasis original)

Indeed, Appellant argues that "it is clear that vaporized gaseous byproducts could — and indeed would — travel by random motion from the surface of the work product around the exposure mask and condense on the chamber window." (Reply Brief at 5.)

In view of our disposition of this appeal, we need not dwell on Appellant's arguments with respect to the dependent claims, save to observe that the Appellant urges that the examiner has failed to support the rejections with teachings or suggestions in the prior art.

2. Discussion

In any rejection for obviousness over prior art references, the burden is on the examiner to demonstrate that the prior art references teach, expressly or inherently, every limitation of the claimed subject matter; and, when references must be combined, that there is a reason, suggestion, teaching, or motivation arising out of the references, such that one of ordinary skill in the art would have combined them in such a way as to arrive at the claimed invention. *In re Vaeck*, 947 F.2d 488, 493, 20 USPQ2d 1438, 1442 (Fed. Cir. 1991). Moreover, findings of fact must be supported by substantial evidence in the record. *In re Lee*, 277 F.3d 1338, 1344-45, 61 USPQ2d 1430, 1435 (Fed. Cir. 2002) ("The Board's findings must extend to all

material facts and must be documented on the record, lest the 'haze of so-called expertise' acquire insulation from accountability. 'Common knowledge and common sense,' even if assumed to derive from the agency's expertise, do not substitute for authority when the law requires authority.")(citations omitted).

In the present case, we agree with the examiner that Noguchi discloses a system that meets every limitation of claim 1, but for the presence of the buffer layer and the functional properties required of the buffer layer. Kondo, however, stands on a different footing. As we have described Kondo, *supra*, we find that Kondo does not teach laser-induced crystallization of an amorphous substrate: rather the crystallization results from a subsequent thermal heating of the substrate. Thus, for the purposes of the rejection on appeal, we find that the only relevant teaching of Kondo that is that a mask may be used in conjunction with a light source in order to expose a substrate to a desired pattern of radiation. Moreover, we note that the examiner has failed to direct our attention to any details or teachings in Kondo regarding the size or placement of the mask relative to the substrate. Nor has the examiner indicated where Kondo discloses placing the substrate inside a chamber. Hence,

Kondo is silent as to the disposition of the exposure mask relative to such a chamber. In sum, there is no teaching in Kondo that we may rely on to support a suggestion of where to position the exposure mask in the system disclosed by Noguchi.

As for Noguchi, we have observed *supra* that Noguchi does teach the use of a reticle as part of the optical delivery system to expose the substrate to a pattern of light. The examiner has directed our attention to no teaching in Noguchi, however, that a reticle or exposure mask may be advantageously positioned inside the sample chamber. The examiner has not established any other facts in the record in support of placing an exposure mask inside the sample chamber provided by Noguchi. Accordingly, we are constrained to reverse the rejection for lack of an adequate evidentiary basis for the proposed modification.

It seems to us that when a reference provides a way of achieving a certain result, but mentions no other, then, to establish that one of ordinary skill in the art would have recognized that some other way might also be used, a proper rejection must cite some teaching in the prior art in support of that other way. Appeal to "common knowledge" of a property of a material or of the behavior of a system may establish the "reasonableness" of a proposed modification: but proof of

obviousness requires more than proof of reasonableness. Most inventions are, after all, reasonable. The additional requirement is substantial evidence that the modification and its reasonableness would have been recognized. The record developed by the examiner is inadequate because it lacks substantial evidence supporting positioning an exposure mask between the chamber window and the substrate. The incidental character of Kondo's disclosures regarding masks leaves a vacuum that the examiner's attempts to fill by reference to common knowledge or common sense cannot fill.

Further considerations

In the event of further prosecution, we recommend that the examiner and Appellant consider the following issues.

a. What is the scope of the term "substantially block the byproduct from reaching the window"? This term is present in claim 1, but absent from independent claims 19 and 29, and all claims dependent on the latter two but for claims 35 and 36, which were added after the final rejection. (See Paper No. 13.) The term was introduced to independent claim 1, apparently from original dependent claim 5, in the amendment responding to the first office action on the merits. (See Paper No. 5, filed May 27, 1999, at 1-2.) There is no limiting condition in the claims

that gives a clear meaning to this term; nor is there a clear definition in the specification. Relative terms are not *per se* indefinite, provided there is some reasonable measure of their scope. *See Seattle Box Co. v. Indus. Crating & Packing, Inc.*, 731 F.2d 818, 826, 221 USPQ 568, 574 (Fed. Cir. 1984) (a term of degree is definite if the specification "provides some standard for measuring that degree. . . . that is, whether one of ordinary skill in the art would understand what is claimed when the claim is read in light of the specification."). Appellant has discussed the extent of blocking obtained by the claimed invention (specification at 9; cited by Appellant in Paper No. 5 at 3), but it is not clear whether the discussion was directed to the scope of all of the claims, or whether that construction was limited to the merely particular embodiments within the scope of claim 1. This issue, which is not before us for review, should be addressed in the first instance by the examiner and Appellant in view of the extensive considerations of facts and context required for its resolution.

b. While the present posture of the case does not require that we address the merits of the arguments with respect to the dependent claims, we observe that the examiner has not supported the rejections for obviousness of claimed subject matter

containing the additional limitations with citations to prior art reference in the record. In the event the examiner determines that rejections over additional prior art are warranted, we emphasize that references must be cited in support of all findings of fact. While appeal to common knowledge or common sense may support the reasoning for a rejection for obviousness, such appeals fail to establish the factual basis on which a rejection must be based.

3. Decision

Upon consideration of the appeal, and solely for the reasons given, The rejection is reversed.

REVERSED.

BRADLEY R. GARRIS Administrative Patent Judge	
BEVERLY A. PAWLIKOWSKI Administrative Patent Judge	BOARD OF PATENT APPEALS AND INTERFERENCES
MARK NAGUMO Administrative Patent Judge	

cc (via First Class mail):

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