Paper No. 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 TATSUYA ADACHI, TAKASHI KAITO, YOSHIHIRO KOYAMA and KOUJI IWASAKI

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Appeal No. 1998-2405
Application 08/351,093

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ON BRIEF

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Before OWENS, DELMENDO and PAWLIKOWSKI, *Administrative Patent Judges*.

OWENS, *Administrative Patent Judge*.

DECISION ON APPEAL

This is an appeal from the examiner's final rejection of claims 1-14, which are all of the claims in the application.

THE INVENTION

The appellants' claimed invention is directed toward a method for micromachining a sample, such as a semiconductor

material, to prepare the sample for observation which detects electron or ion beam radiation penetrating the sample, the observation generally being carried out using a transmission electron microscope (specification, page 1, lines 1-5). Claim 1 is illustrative:

1. A method for preparing a sample for observation, the sample having a surface, said method comprising:

delivering a spray of an organic compound vapor to a first area of the sample surface while scanning the first area with a focussed ion beam to decompose the organic compound into a layer having a mask function, wherein the layer covers the first area and at least part of the first area has a width; and

delivering a spray of an etching gas to a second area of the sample surface while irradiating the second area with an ion beam in order to remove material from the sample surface at the second area, thereby leaving an isolated portion of the sample, wherein the second area includes at least part of the first area, the layer covering the first area prevents removal of material from the sample surface in the first area and the isolated portion has a thickness equal to the width of the part of the first area.

THE REFERENCES

Jelks et al. (Jelks)	4,612,085	Sep. 16, 1986
Kaito et al. (Kaito)	4,876,112	Oct. 24, 1989
Seki et al. (Seki)	5,145,554	Sep. 8, 1992
Franke et al. (Franke)	5,378,316	Jan. 3, 1995

(effective filing date Apr. 3, 1991)

Iwasaki et al. (Iwasaki) 5,525,806 Jun. 11, 1996

Nakagawa et al. (Nakagawa) 0 153 854 Sep. 4, 1985
(European patent application)

Tanemura et al. (Tanemura)[1] 04-337445 Nov. 25, 1992
(Japanese Kokai)

Takahashi et al. (Takahashi) 05-034250 Feb. 9, 1993
(Japanese Kokai)

Ozaki 05-136097 Jun. 1, 1993
(Japanese Kokai)

THE REJECTIONS

The claims stand rejected under 35 U.S.C. § 103 as follows: claims 1-4 and 9-13 over Franke in view of Nakagawa and Ozaki; claims 1-4 and 9-13 over Seki in view of Jelks and Kaito; and claims 1-14 over Tanemura in view of Franke, Nakagawa, Ozaki and Takahashi. Claims 1-14 also stand

[1] Our consideration of Tanemura, Takahashi and Ozaki is based upon English translations thereof, copies of which are provided to the appellants with this decision.

rejected under the judicially created doctrine of obviousness-type double patenting over the claims of Iwasaki in view of Franke.[2]

OPINION

We reverse the aforementioned rejections. We need to address only claim 1, which is the sole independent claim.

Rejection over Franke in view of Nakagawa and Ozaki

Franke discloses a method for dry etching GaAs in chlorine-containing ambients using an amorphous carbon mask (col. 2, lines 17-22). Franke teaches that the mask material can be applied by a number of techniques including ion plating (col. 2, lines 39-48), but does not disclose applying the mask material by spraying an organic compound vapor onto a surface while scanning the surface with a focused ion beam. In an example, after the mask has been patterned, the GaAs is etched using ion beam assisted etching (col. 1, lines 42-44; col. 4, lines 27-31).

Nakagawa discloses applying a patterned film by scanning

[2] Rejections of claims 1-4 and 9-14 under 35 U.S.C. §§ 102 and 103 over Tanemura are withdrawn in the examiner's answer (page 2).

a specific portion of a sample with a focused ion beam in an atmosphere containing a tri- or tetracyclic aromatic compound vapor, thereby polymerizing or carbonizing the organic compound on the portion of the sample irradiated by the scanned ion beam (page 3, lines 1-15; page 4, lines 22-31; page 5, lines 24-27). Nakagawa teaches that this technique has the benefit of forming patterns less than one micron wide in a short time in a single step (page 7, lines 29-33).

Ozaki discloses a method for forming fine patterns by irradiating a semiconductor substrate with an electron beam in a hydrocarbon atmosphere containing at least methane and ethane to form a film selectively on the irradiated portions of the substrate, and etching exposed parts of the substrate by reactive ion etching using the film as a mask (pages 6-7 and 9).

The examiner argues that because Ozaki's method is similar to that of Nakagawa, one of ordinary skill in the art would have had a reasonable expectation of success in substituting Nakagawa's film formation technique for that of Franke in order to provide a film which is resistant to ion beam etching and which is formed using less steps, time and

equipment (answer, pages 4-5). The examiner, however, has not established that one of ordinary skill in the art would have reasonably expected Nakagawa's ion beam method to produce a film having a resistance to reactive ion etching which is similar to that of a film produced by Ozaki's electron beam method. The examiner has merely provided speculation to that effect, and such speculation is not sufficient for establishing a *prima facie* case of obviousness. *See In re Warner*, 379 F.2d 1011, 1017, 154 USPQ 173, 178 (CCPA 1967), *cert. denied*, 389 U.S. 1057 (1968); *In re Sporck*, 301 F.2d 686, 690, 133 USPQ 360, 364 (CCPA 1962). Accordingly, we reverse the rejection over Franke in view of Nakagawa and Ozaki.

Rejection over Seki in view of Jelks and Kaito

The portion of Seki relied upon by the examiner discloses masking a ZnSe substrate using a nickel, molybdenum or tungsten mask formed by sputtering, and then etching the ZnSe using an ion beam (col. 13, line 40 - col. 14, line 12).

Kaito discloses forming a metallic patterned film by scanning a substrate with a converging ion beam while blowing

a stream of hexacarbonyl metal vapor toward the substrate in the area irradiated by the ion beam (col. 1, line 37 - col. 2, line 3).

Jelks discloses forming a molybdenum oxide etch mask by scanning a substrate with a laser in the presence of molybdenum hexacarbonyl, and then using the mask when plasma etching an underlying polyimide layer (col. 3, lines 19-62).

The examiner argues that Jelks would have provided one of ordinary skill in the art with a reasonable expectation of success in reducing steps, time and equipment by using Kaito's method to form Seki's film (answer, page 6). The examiner, however, has not established that one of ordinary skill in the art would have reasonably expected Kaito's ion beam method to produce a film having a resistance to plasma etching which is similar to that of a film produced by Jelks' laser method. Thus, the examiner has not carried the burden of establishing a *prima facie* case of obviousness of the claimed invention. Accordingly, we reverse the rejection over Seki in view of Jelks and Kaito.

Rejection over Tanemura in view of Franke, Nakagawa, Ozaki and Takahashi

Tanemura discloses a method for preparing a sample to be examined using a transmission electron microscope, the method comprising scanning the sample with radiation in the presence of carbon-containing molecules floating in the atmosphere to dissociate the molecules and thereby form a film in the irradiated region, and then irradiating the sample with an ion ray to remove portions of the sample not covered by the film (pages 5 and 7). Regarding the type of radiation used in forming the film, Tanemura states: “The irradiation is carried out by means of radiations, i.e., electron ray, laser light, X-ray, neutron ray or (-ray, etc. having energy necessary for deposition of the molecules. Easily controllable electron ray, laser light and X-ray are desired among them” (page 6). The reference does not disclose forming the film using ion beam radiation.

The examiner argues that, in view of the combined teachings of Franke, Nakagawa and Ozaki, it would have been obvious to one of ordinary skill in the art to form Tanemura’s film using ion beam radiation “based upon the commonality of the reactive etch conditions in the references and the equivalence of the deposited materials with conventional

resists" (answer, pages 7-8). As discussed above with respect to the rejection over Franke in view of Nakagawa and Ozaki, the examiner has not established that these references would have provided one of ordinary skill in the art with a reasonable expectation of success in using ion beam irradiation to form a film which is resistant to Franke's ion beam assisted etching. Similarly, the examiner has not established that the applied references would have fairly suggested, to one of ordinary skill in the art, using ion beam irradiation to form Tanemura's film.[3] Hence, we reverse the rejection over Tanemura in view of Franke, Nakagawa, Ozaki and Takahashi.

Obviousness-type double patenting rejection over the claims of Iwasaki in view of Franke

The examiner relies upon only claims 4-6 of Iwasaki (answer, page 8). These claims recite methods of preparing a sample for observation comprising irradiating a surface of the sample with a scanning focused ion beam to form a thin film on

[3] The examiner relies upon Takahashi only for a teaching of using a particular technique to determine etching depth (answer, pages 7-8), and not for any teaching which remedies the above-discussed deficiencies in the other applied references.

the surface, irradiating the thin film with a focused electron beam, and determining the thickness of the thin film based upon the intensity of detected electrons or X-rays emitted from the thin film as a result of the irradiation with the electron beam.

The examiner argues that Franke teaches that addition of reactive chlorinated species to a chamber during ion beam etching was known in the art (answer, pages 8-9). The examiner, however, has not established that the claims of Iwasaki, in combination with Franke, would have fairly suggested, to one of ordinary skill in the art, the step required by the appellants' claims of spraying an etching gas while irradiating the sprayed area with an ion beam. The examiner, therefore, has not carried the burden of establishing a *prima facie* case of obviousness over the claims of Iwasaki in view of Franke. Accordingly, we reverse the obviousness-type double patenting rejection.

DECISION

The rejections under 35 U.S.C. § 103 of claims 1-4 and 9-13 over Franke in view of Nakagawa and Ozaki, claims 1-4 and

9-13 over Seki in view of Jelks and Kaito, and claims 1-14 over Tanemura in view of Franke, Nakagawa, Ozaki and Takahashi, and the rejection under the judicially created doctrine of

obviousness-type double patenting of claims 1-14 over the claims of Iwasaki in view of Franke, are reversed.

REVERSED

TERRY J. OWENS Administrative Patent Judge	)	
ROMULO H. DELMENDO Administrative Patent Judge	)	BOARD OF PATENT APPEALS AND INTERFERENCES
BEVERLY A. PAWLIKOWSKI Administrative Patent Judge	)	

TJO/ki

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