

The opinion in support of the decision being entered today was **not** written for publication and is **not** binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

---

BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

---

*Ex parte* MASAHIKO OHUCHI

---

Appeal No. 2005-0202  
Application No. 09/348,654

---

ON BRIEF

---

Before KIMLIN, TIMM, and PAWLIKOWSKI, *Administrative Patent Judges*.  
TIMM, *Administrative Patent Judge*.

***DECISION ON APPEAL***

This appeal involves claims 1-7 and 9 which are all the claims pending in the application.  
We have jurisdiction over the appeal pursuant to 35 U.S.C. § 134.

### ***INTRODUCTION***

The Examiner maintains rejections under 35 U.S.C. § 103(a). As evidence of unpatentability, the Examiner relies upon the following prior art references:<sup>1</sup>

Landau et al. (Landau)	4,592,800	Jun. 3, 1986
Konno et al. (Konno)	5,397,432	Mar. 14, 1995
Yachi	5,578,163	Nov. 26, 1996

Admitted Prior Art, specification, page 3, last paragraph and page 4.

The claims are rejected by the Examiner as follows:<sup>2</sup>

1. Claims 1-6 and 9 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Konno, Admitted Prior Art, and Yachi.
2. Claim 7 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Konno, Admitted Prior Art, and Yachi and further in view of Landau.

As the Appellant states that all the claims stand or fall together (Brief, p. 6), we select claims 1 and 7 to represent the issues on appeal. Claims 1 and 7 read as follows:

---

<sup>1</sup>As prior art of record, the Examiner also lists U.S. Patent 5,763,328 issued to Yoshihara. Yoshihara is discussed in the first ground of rejection (Answer, p. 3 and p. 5), but Yoshihara is not listed in the statement of any rejection. "Where a reference is relied on to support a rejection, whether or not in a 'minor capacity,' there would appear to be no excuse for not positively including the reference in the statement of rejection." *In re Hoch*, 428 F.2d 1341, 1342 n.3, 166 USPQ 406, 407 n.3 (CCPA 1970). We do not consider Yoshihara.

<sup>2</sup>The Examiner has withdrawn a rejection under 35 U.S.C. § 112, ¶ 1 (Answer, p. 3).

1. A process for patterning a target layer, comprising the steps in sequence of:

a) preparing a semiconductor structure having said target layer covered with an etching mask formed of photo-resist;

b) heating said semiconductor structure from step a) to an initial temperature of between 50 degrees centigrade and 100 degrees centigrade and exposing said semiconductor structure to an etchant containing halogen so as to form said target layer into a pattern partially covered with unintentional layers of etching residue containing pieces of said photo-resist and halide;

c) heating the resultant structure of step b), over a time period of 30 to 70 seconds, from said initial temperature to a second temperature of between 100 degrees centigrade and 200 degrees centigrade and exposing the resultant structure of step b) to a gaseous mixture containing ionic water vapor where at least one of  $H^+$  and  $OH$  exists so that said halide reacts with said at least one  $H^+$  and  $OH$ ; and

d) heating the resultant structure of step c) from said second temperature to a target ashing temperature of between 200 degrees centigrade and 250 degrees centigrade and ashing said photo-resist so as to remove said etching mask from the resultant structure of step c).

7. The process as set forth in claim 6, in which said etching gas further contains hydrofluorocarbon expressed as  $CH_{4-x}F_x$ .

Appellant has not convinced us of reversible error on the part of the Examiner. We, therefore, affirm. Our reasons follow.

### ***OPINION***

#### ***Claim 1***

Claim 1 is directed to a process for patterning a target layer residing on a semiconductor substrate. In this process, the target layer is masked with photo-resist (step a) and subjected to

dry etching (step b) to pattern the target layer. After etching, an anti-after-corrosion treatment is conducted to remove etching residue (step c) and then the photo-resist is removed by ashing (step d).

The process of the claims is used in the formation of conductive lines in semiconductor devices. Konno describes such a process with steps of masking, etching, anti-after-corrosion treatment and ashing. As acknowledged by the Examiner, Konno does not describe performing the anti-after-corrosion treatment prior to the ashing step. In Konno, the anti-after-corrosion treatment is performed either concurrently with ashing or after ashing (Konno, abstract; col. 3, l. 51 to col. 4, l. 10). But, as found by the Examiner, not only were concurrent anti-after-corrosion treatment and after anti-after-corrosion treatment known in the prior art, but anti-after-corrosion treatment before ashing was also known to those of ordinary skill in the art (Answer, p. 4 referring to Admitted Prior Art, specification, p. 4).<sup>3</sup> We agree with the Examiner that the evidence indicates that those of ordinary skill in the art understood that the steps could be conducted in any of the known sequences.

In the arguments, Appellant focuses on a portion of the rejection in which *Ex parte Rubin* was cited for the proposition that “in general, the transposition of process steps or the splitting of one step into two, where the processes are substantially identical or equivalent in terms of function, manner and result, was held to [] not patentably distinguish the processes.” (Brief, p. 7 quoting Final Rejection, p. 3). Appellant argues that “[i]n reaching this conclusion, the

---

<sup>3</sup>Appellant does not contest the finding of the Examiner that the discussion in the last paragraph of page 3 and on page 4 of the specification is admitted prior art. We, therefore, accept the finding as true.

Examiner has ignored the express teachings of Appellant's sworn specification that the order in which conventional ashing and etching residue removing steps are performed is in fact critical." (*Id.*).

The problem with Appellant's argument is that there is no foundation of evidence relied upon to support the asserted criticality. Such evidence is required because the evidence relied upon by the Examiner is sufficient to support a *prima facie* case of obviousness. *See In re Fortess*, 369 F.2d 1009, 1017, 152 USPQ 13, 19-20 (CCPA 1966). This is because, according to the Admitted Prior Art, processes including both an etching residue removing step (anti-after-corrosion step; claim 1, step c), and an ashing step (claim 1, step d) were known in the prior art, each step known to produce a particular effect. Moreover, the evidence shows that performance of the steps in any of the three possible sequences, one before the other in either order or concurrently, was known (Admitted Prior Art, specification, p. 4). The evidence indicates that those of ordinary skill in the art would have understood that a workable result would occur with each: the anti-after-corrosion step would remove etching residue and the ashing step would remove photo-resist. That is enough to establish a *prima facie* case and shift the burden to Appellant to demonstrate patentability through secondary considerations such as unexpected results. *Fortess*, 369 F.2d at 1017, 152 USPQ at 19-20; *In re Piasecki*, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984). "[I]t is well settled that unexpected results must be established by factual evidence." *In re Geisler*, 116 F.3d 1465, 1470, 43 USPQ2d 1362, 1365 (Fed. Cir. 1997). Appellant has not provided the level of factual evidence required.

We are cognizant of the fact that the specification indicates that the different sequences of steps result in somewhat different results and that there are trade-offs for each sequence (specification, pp. 4-5; *see* Reply Brief, pp. 2-3). However, the fact that there are some differences does not negate the teaching that all three sequences were known by those of ordinary skill in the art. Nor do the discussed differences provide the requisite level of evidence needed to show criticality for the claimed sequence of steps. *See In re Klosak*, 455 F.2d 1077, 1080, 173 USPQ 14, 16 (CCPA 1972) (“[I]t 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”).

Appellant also argues that there are other differences between the claimed invention and the prior art (Brief, pp. 8-9). These differences, however, are in the nature of temperature and time adjustments; adjustments which one of ordinary skill in the art would have routinely made to optimize the results of the process. It is well settled that where patentability is predicated upon a change in condition of a prior art process, such as a change in temperature, the burden is on the applicant to establish the nonobviousness of the process through unexpected results or other evidence of secondary considerations. *See In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990); *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Appellant asserts that neither the cited art nor the Admitted Prior Art teaches that the ashing temperature is a result-effective variable, i.e., the ashing rate is dependent on temperature

(Reply Brief, p. 4). That the ashing temperature was understood to affect the results of ashing can hardly be questioned. Such is evidenced by language in Konno such as: “[t]hen, the substrate 1 is heated, for example, to 100° to 200° C.” (Konno, col. 6, ll. 12-13). One of ordinary skill in the art is clearly expected to perform routine experimentation to determine the workable or optimal temperature for ashing.

Appellant also argues that Konno teaches against the introduction of water vapor prior to ashing (Brief, p. 9 referring to column 10, lines 5-16 of Konno). First, the Admitted Prior Art indicates that performance of the anti-after-corrosion treatment before ashing was known in the art. Second, we agree with the Examiner that Konno does not teach against the introduction of water vapor for the anti-after-corrosion treatment prior to ashing (Answer, p. 7). The portion of Konno referenced by Appellant discusses the performance of the anti-after-corrosion and ashing steps separately but in the same apparatus. Konno then discusses a way to overcome the problem of water vapor removal by using an apparatus with separate stations for the anti-after-corrosion treatment and ashing steps (Konno, col. 10, ll. 9-17). One would simply use separate stations to overcome the problem. There is no teaching away from performing anti-after-corrosion treatment prior to ashing in Konno.

***Claim 7***

To reject claim 7, the Examiner adds Landau. Claim 7 requires that the etching gas contain hydrofluorocarbon expressed as  $\text{CH}_{4-x}\text{F}_x$ .

Appellant argues that despite a rather extensive shopping list of halogen compounds, Landau fails to specifically teach a  $\text{CH}_{4-x}\text{F}_x$  compound and teaches that compounds of bromine and fluorine are undesirable (Brief, p. 11).

First of all, some of the “shopping list of halogen compounds” listed by Appellant are disclosed in Landau not as etchants, but as substitute adsorbent gaseous species (Landau, col. 4, ll. 31-34). What Landau discloses in terms of etchants is the use of  $\text{SiCl}_4$  and  $\text{Cl}_2$ ,  $\text{SCl}_6$ ,  $\text{SiCl}_4$ ,  $\text{BCl}_3$  plus  $\text{Cl}_2$ ,  $\text{BCl}_3$ ,  $\text{CCl}_4$ ,  $\text{CHCl}_3$ , and  $\text{C}_2\text{HCl}_3$  and compounds of other halogens, e.g., compounds of bromine and fluorine (Landau, col. 4, ll. 12- 22). This disclosure suggests  $\text{CH}_{4-x}\text{F}_x$  compounds such as  $\text{CF}_4$  and  $\text{CHF}_3$  as those are homologs to the chlorine compounds listed.

Second, Landau does not teach away from using compounds of fluorine. That Landau indicates that the chlorine compounds are, as a practical matter, more extensively used does not negate the fact that the use of fluorine compounds is also taught. A reference may be relied upon for all that it would have reasonably suggested to one having ordinary skill in the art, including non-preferred embodiments. *Merck & Co v. Biocraft Labs., Inc.*, 874 F.2d 804, 807, 10 USPQ2d 1843, 1847 (Fed. Cir.), *cert. denied*, 493 U.S. 975 (1989). Disclosed examples and preferred embodiments do not constitute a teaching away from a broader disclosure or non-preferred embodiments. *In re Susi*, 440 F.2d 442, 446 n.3, 169 USPQ 423, 426 n.3 (CCPA 1971).

We conclude that the Examiner has established a *prima facie* case of obviousness with respect to the subject matter of claims 1-7 and 9 which has not been sufficiently rebutted by Appellant.

**CONCLUSION**

To summarize, the decision of the Examiner to reject claims 1-7 and 9 under 35 U.S.C. § 103(a) is affirmed.

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

AFFIRMED

EDWARD C. KIMLIN	)	
Administrative Patent Judge	)	
	)	
	)	
	)	
	)	BOARD OF PATENT
CATHERINE TIMM	)	APPEALS
Administrative Patent Judge	)	AND
	)	INTERFERENCES
	)	
	)	
	)	
BEVERLY A. PAWLIKOWSKI	)	
Administrative Patent Judge	)	

Appeal No. 2005-0202  
Application No. 09/348,654

Page 10

Norman P. Soloway  
Hayes Soloway Hennessey  
Grossman & Page PC  
175 Canal Street  
Manchester, NH 03101