UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte ELIZABTH J. PODLAHA,
and AMRIT PANDA

Appeal 2008-3288
Application 10/364,590
Technology Center 1700

Decided: September 24, 2008

Before BRADLEY R. GARRIS, CATHERINE Q. TIMM, and KAREN M. HASTINGS, *Administrative Patent Judges*.

GARRIS*, Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134 from the Examiner's decision rejecting claims 1-14. We have jurisdiction under 35 U.S.C. § 6.

We AFFIRM.

Appellants claim a process for making a metal composite microstructure comprising: (a) supplying into a mold, having a depth of at

least about 10μm and having an aspect ratio greater than about 1, an aqueous solution comprising a metal (e.g., nickle) salt and nanoparticulates and (b) depositing the metal and particulates by pulsed electroplating wherein the pulses have an on time that is sufficiently short, and a duty cycle that is sufficiently low, that the products of the electroplating reactions and any side reactions do not accumulate in concentrations that are sufficiently high to substantially interfere with the electroplating, and wherein the depositing of the metal is under mass transport control.

Further details of this claimed process are set forth in representative claim 1, the sole independent claim on appeal, which reads as follows:

1. A process for making a metal composite microstructure comprising at least one metal selected from the group consisting of nickel, copper, iron, tungsten, cobalt, molybdenum, gold, zinc, silver, chromium, tin, and lead; said process comprising the steps of:

(a) supplying into a mold an aqueous solution comprising a salt of the metal and comprising suspended particulates; wherein the shape of the mold is complementary to the shape of the microstructure to be made, and wherein the mold includes one or more deep recesses having a depth of at least about 10 μm, and having an aspect ratio greater than about 1; and wherein the particulates have a number-average diameter less than about 500 nm; and

(b) depositing the metal from the aqueous solution into the mold by pulsed electroplating; wherein the electroplating pulses have an on time that is sufficiently short, and a duty cycle that is sufficiently low, that the products of the electroplating reactions and the products of any side reactions do not accumulate in concentrations that are sufficiently high to substantially interfere with the electroplating of the desired metal into the deep recesses; and wherein said depositing step is continued until a metal composite microstructure has been formed having a height of at least about 10 μm, and having an aspect ratio greater than about 1; wherein the composite microstructure comprises an intermixture of metal and particulates; wherein the concentration of the particulates is such that the rate at which the metal is deposited is faster than the metal would be

deposited in an otherwise identical process lacking the particulates; and wherein the depositing of at least one of the metals is under mass transport control.

The references set forth below are relied upon by the Examiner as evidence of obviousness:

Yamashita	4,820,387	Apr. 11, 1989
Nee	4,869,971	Sep. 26, 1989
Dubin	5,972,192	Oct. 26, 1999
Taylor	6,524,461 B2	Feb. 25, 2003

Greco, V., "A Review Of Fabrication And Properties Of Electrocomposites," *Plating and Surface Finishing*, 68-72 (Oct. 1989).

Ehrfeld, W., "Materials of LIGA Technology," *Microsystem Technologies* 5, 105-112 (1999).

Kerr, C., "The Electrodeposition of Composite Coatings Based on Metal Matrix-Included Particle Deposits," *Trans. IMF* 78(5), 171-178 (2000).

In addition, claims 16-27 of copending application 10/196,764 are relied upon by the Examiner in support of an obviousness-type double patenting rejection.

Claims 1-3, 6-9, and 12 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Ehrfeld in combination with Taylor and Dublin and further in view of Yamashita, and the remaining claims on appeal are correspondingly rejected over these references and further in view of Nee, Kerr, and Greco.

Claims 1-14 also are rejected under the judicially-created doctrine of obviousness-type double patenting as being unpatentable over claims 16-27 of the copending ‘764 application in view of Ehrfeld.

Appellants have separately argued independent claim 1 only (Supp. Br. 3-4). Accordingly, the dependent claims on appeal including the separately rejected dependent claims will stand or fall with independent claim 1.

For the reasons expressed in the answer and below, we will sustain each of the above-noted rejections.

The § 103 rejections

The Examiner finds that Ehrfeld discloses a process for making metal composition microstructures by electroplating into a mold having the claim 1 depth and aspect ratio (Abstract at 105, para. bridging 106-107) a metal in combination with nanoparticles which yield desirable properties such as hardness (last full para. at 107, Table 1 at 108) (Ans. 3-4). The Examiner acknowledges that Ehrfeld does not teach depositing metal by the pulse electroplating technique of claim 1 but finds that Taylor, Dubin, and Yamashita would have suggested such a technique (Ans. 4-5). Specifically: Taylor teaches depositing metal in a high aspect ratio recess (col. 3, ll. 38-45, col. 4, ll. 18-43) via pulsed electroplating with cathodic deposition having short pulses and low duty cycles wherein the duty cycles are lower as the aspect ratio increases (col. 13, ll. 12-19 and 53-57, col. 14, ll. 45-51); Dubin teaches depositing metal in high aspect ratio openings via pulsed electroplating (Abstract) wherein "one having ordinary skill in the art could easily optimize the relevant variables, such as the duty cycle, frequency and current density in a particular situation" (col. 5, ll. 64-67); and Yamashita discloses depositing metal via pulsed electroplating with a duty cycle of 1 to 30% (Abstract).

Based on these findings, the Examiner concludes that it would have been obvious for one with ordinary skill in this art to perform Ehrfeld's step of electroplating metal and nanoparticles into a high aspect ratio mold via pulsed electroplating with a short on time and a low duty cycle which are optimized to provide effective deposition results in a high aspect ratio environment as taught by Taylor, Dubin, and Yamashita (Ans. 5, 11-12).

Appellants argue that Ehrfeld provides no enabling details concerning the above discussed process of making a metal composition microstructure in a high aspect ratio mold by depositing metal in combination with nanoparticles (Appl. Br. 19; Reply Br. 7-9). However, Appellants have provided the record of this appeal with no evidence that an ordinarily skilled artisan would have been unable to practice this process of Ehrfeld. Indeed, Appellants have not even identified any specific details absent from Ehrfeld's disclosure which allegedly would have prevented an artisan from practicing the process. Under these circumstances, we are not convinced by Appellants' argument that one with ordinary skill in this art would not have been able to practice the Ehrfeld process.

Appellants further argue that the applied references contain no teaching or suggestion of the claim 1 features "wherein the depositing of at least one of the metals is under mass transport control" and "wherein the electroplating pulses have an on time that is sufficiently short, and a duty cycle that is sufficiently low, that the products of the electroplating reactions and the products of any side reactions do not accumulate in concentrations that are sufficiently high to substantially interfere with the electroplating of

the desired metal into the deep recesses" (App. Br. 9-10; Reply Br. 4-5).[1] In this regard, Appellants emphasize that the applied references do not appreciate that mass transport dominates deposition in deep recesses and that adding nanoparticles enhances electrodeposition in deep recesses under mass transport control (App. Br. 11-12). Similarly, Appellants urge that the applied references fail to recognize that byproduct accumulation is a problem when electroplating in deep recesses and that the problem is solved by the pulsed electroplating feature required by claim 1 (App. Br. 12-13).

Like the Examiner (Ans. 12-13), we are unpersuaded by these arguments. Because Ehrfeld's process of electroplating metal in a mold involves the same high aspect ratio environment as claim 1, mass transport would necessarily dominate this process in the same way that it dominates the claim 1 process. Likewise, the use of nanoparticles in the process of Ehrfeld would necessarily enhance electrodepositing just as it does in the claim 1 process. Analogously, the secondary references, in particular Taylor and Dubin, teach processes of depositing metal in high aspect ratio environments using pulsed electroplating having short on times and low duty cycles which optimize metal deposition and therefore would necessarily prevent accumulation of by-products that would substantially interfere with the electroplating process as required by claim 1.

The § 103 rejection of claim 1 is not undermined simply because the applied references do not recognize the problems and solutions described by Appellants. This is because it is irrelevant that those using a prior art

[1] The Appeal Brief argument concerning the particulate concentration feature of claim 1 (App. Br. 9-10) has been expressly withdrawn by Appellants (Reply Br. 3-4).

process may not have appreciated the results thereof where the operation is a consistent, reproducible use of the claimed invention. *W. L. Gore & Assocs. Inc. v. Garlock, Inc*., 721 F.2s 1540, 1548, (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984). The results which Appellants attribute to the claim 1 process are the necessary consequences of practicing the prior art processes in the manner intended. It is of no import that the prior art did not appreciate these results. *Mehl/Biophile Int'l Corp. v. Milgraum,* 192 F.3d 1362, 1366 (Fed. Cir. 1999).

Accordingly, it is irrelevant that Ehrfeld may not have appreciated that the use of nanoparticles enhances electrodeposition in a high aspect ratio environment. Similarly, it is irrelevant that Taylor and Dubin may not have appreciated that pulsed electroplating having short on times and low duty cycles avoids a product accumulation problem in high aspect ratio environments. In each of these prior art processes, the problems described by Appellants were necessarily averted using nanoparticles and pulsed electroplating in the manner required by claim 1.

In addition, Appellants argue that no motivation exists for combining the applied reference teachings in the manner proposed by the Examiner (App. Br. 13-14; Reply Br. 6). More particularly, Appellants contend that "[t]he combination of nanoparticles and slow, pulsed electrodeposition leads to substantial advantages in producing high aspect ratio microstructures" and that "[n]one of the cited references suggests either this combination, or its resulting advantages" (App. Br. 13).

Contrary to Appellants' belief, an artisan would have been motivated to combine the applied reference teachings in the manner discussed above based on the reasonable expectation that the pulsed electroplating techniques

of Taylor and Dublin would improve Ehrfeld's process of making metal composition microstructures by electroplating a metal in combination with nanoparticles. This is because Taylor and Dublin, as explained previously, teach enhanced metal deposition in high aspect ratio environments via pulsed electroplating which includes short on times and low duty cycles that optimize deposition results. Since the metal deposition of Ehrfeld's process also occurs in a high aspect ratio environment, an artisan would reasonably expect this deposition process to be successfully enhanced by the pulsed electroplating techniques of Taylor and Dublin. *See Pfizer, Inc. v. Aptoex, Inc.*, 480 F.3d 1348, 1364 (Fed. Cir. 2007) (the expectation of success need only be reasonable, not absolute).

Finally, Appellants argue that a conclusion of nonobviousness is supported by *KSR Int'l Co., v. Teleflex, Inc*., 127 S. Ct. 1727 (2007) (Reply Br. 10-11). We do not agree.

This argument is premised on Appellants' proposition that the claim 1 use of pulsed electroplating and nanoparticles went beyond their established functions in the prior art and yielded unexpected results (Reply Br. 10). We have earlier explained, however, that the use of nanoparticles by Ehrfeld and the use of pulsed electroplating by Taylor and Dubin would necessarily yield the same results as the claim 1 process since the high aspect ratio environment is the same in each case. It follows that Appellants have merely discovered features of Ehrfeld's process and of the pulsed electroplating techniques taught by Taylor and Dubin which were unappreciated but necessarily achieved in following these prior art teachings. Viewed from this perspective, the claim 1 use of nanoparticles and pulsed electroplating is simply the predictable use of nanoparticles to

achieve desirable properties such as hardness in accordance with Ehrfeld's teaching (last full para. at 107)[2] and the predictable use of pulsed electroplating in order to enhance metal deposition in high aspect ratio environments as taught by Taylor and Dublin. *See KSR*, 127 S. Ct. at 1740 (a court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions). In this case, the improvements described by Appellants are necessary aspects of the prior art and therefore do not support a nonobviousness conclusion.

According to *KSR*, the underlying principle for assessing obviousness is "to determine whether there was an apparent reason to combine the known elements in the fashion claimed" (*id.*, 127 S. Ct. at 1741). Here, Ehrfeld's known process of depositing metal along with nanoparticles would have been combined with the known pulsed electroplating techniques of Taylor and Dubin in order to enhance Ehrfeld's deposition in a high aspect ratio environment pursuant to the teachings of Taylor and Dubin. Thus, on the record before us, an apparent reason exists for combining these prior art features in the fashion required by claim 1.

For the above stated reasons, we sustain each of the § 103 rejections before us in this appeal.

The obviousness-type double patent rejection

The Examiner finds that claims 16-27 of copending application '764 define a process corresponding to appealed claim 1 except for the claim 1

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[2] As taught in the Specification, the use of nanoparticulates in Appellants' process also produces desirable properties such as greater hardness (Spec. para. [0023]).

use of nanoparticulates which use is disclosed by Ehrfeld (as previously detailed) (Ans. 9). The Examiner concludes that it would have been obvious for one with ordinary skill in this art to modify the process of copending claims 16-27 by including nanoparticles with the metal to-be-deposited in order to achieve desirable properties such as hardness in accordance with the teachings of Ehrfeld (*id.*).

Appellants argue that Ehrfeld contains no teaching or suggestion of the appealed claim 1 feature "wherein the depositing of at least one of the metals is under mass transport control" (App. Br. 17-18).[3]

This argument is unpersuasive for the reasons fully explained above with respect to the § 103 rejection.

Therefore, we sustain the obviousness-type double patenting rejection of claims 1-14 as being unpatentable over claims 16-27 of the copending '764 application in view of Ehrfeld.

Conclusion

The decision of the Examiner 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)(iv).

AFFIRMED

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[3] We again point out that the Appeal Brief argument concerning the particulate concentration feature of claim 1 (App. Br. 17-18) has been expressly withdrawn by Appellants (Reply Br. 3-4).

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