

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

Paper No. 32

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte OLLE CLAES ERIK KORDINA
and
MICHAEL JAMES PAISLEY

Appeal No. 2003-1852
Application No. 09/415,402

HEARD: March 2, 2004

Before WARREN, DELMENDO, and PAWLIKOWSKI, Administrative Patent Judges.

DELMENDO, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on an appeal under 35 U.S.C. § 134 (2003) from the examiner's final rejection of claims 1, 4 through 6, 8 through 10, 14 through 16, 18 through 24, 34 through 36, 38, 40 through 42, and 48 through 50 (final Office action mailed Nov. 1, 2002, paper 22). Claim 12, the only other pending claim, is not rejected.

The subject matter on appeal relates to a "method of controlling and encouraging the growth of high quality SiC single crystals in a SiC crystal growth system" (claims 1, 4, 5, 38, and 40-42), a "method of growing high quality single crystals of SiC in a SiC crystal growth system" (claims 6, 8-10, 14-16, 18-24), and a "SiC crystal growth system for high temperature SiC crystal growth" (claims 34-36 and 48-50). Further details of this appealed subject matter are recited in representative claims 1 and 48 reproduced below:

1. A method of controlling and encouraging the growth of high quality SiC single crystals in a SiC crystal growth system, the method comprising
 - directing and maintaining a flow of silane and carbon source gas to a reaction area while heating the silane and the carbon source gas to approximately the reaction temperature;
 - reacting the silane and the carbon source gas in the reaction area to form a vaporized species containing carbon and silicon;
 - directing and maintaining a flow of the vaporized species containing carbon and silicon to a SiC seed crystal under conditions of temperature and pressure at which single crystal growth of silicon carbide will take place upon the seed crystal;
 - substantially preventing the silane from reacting with ambient surroundings other than the carbon source gas by introducing the silane into a SiC crystal growth system comprising graphite that is coated with a material characterized by a melting point above the sublimation temperature of SiC, chemical inertness with respect to silicon and hydrogen at the sublimation temperature, and a coefficient of thermal expansion sufficiently similar to the graphite to prevent cracking between the graphite and the coating at the sublimation temperature.

48. A SiC crystal growth system for high temperature SiC crystal growth, said system comprising a container for receiving a silicon carbide seed crystal and a source of silicon and a source of carbon, wherein said container comprises;

a graphite core from which a coating of a secondary material has been removed;

said secondary material being characterized by a melting point above the sublimation temperature of SiC, chemical inertness with respect to silicon and hydrogen at the sublimation temperature, and a coefficient of thermal expansion sufficiently similar to said graphite core to prevent cracking between said graphite core and said coating during heating and cooling of said container to and from the sublimation temperature of SiC.

The examiner relies on the following prior art references as evidence of unpatentability:

Sugiyama et al. (Sugiyama)	5,964,944	Oct. 12, 1999 (filed Mar. 21, 1997)
Maeda et al. (Maeda) (published EP application)	0 554 047 A1	Aug. 04, 1993
Balakrishna et al. (Balakrishna) (published PCT application)	WO 99/29934	Jun. 17, 1999

Claims 1, 4 through 6, 8 through 10, 14 through 16, 18 through 24, 34 through 36, 38, 40 through 42, and 48 through 50 on appeal stand rejected under 35 U.S.C. § 103(a) as unpatentable over Maeda in view of Balakrishna and Sugiyama. (Examiner's answer mailed Mar. 11, 2002, paper 25, pages 3-5.)

We affirm the rejection as to claims 34 through 36 and 48 through 50 but reverse as to claims 1, 4 through 6, 8 through 10, 14 through 16, 18 through 24, 38, and 40 through 42.¹

Claims 1, 4-6, 8-10, 14-16, 18-24, 38, and 40-42

The examiner states that Maeda teaches a method of growing SiC and that "[v]apors of silicon and carbon are formed by sublimation and heated to temperatures above 2,000° c."

(Answer, page 3.) The examiner then continues: "The vapors are flowed towards a seed crystal and cause to decompose and deposit SiC on the seed [sic], which is cooler then [sic] the vapors. The silicon source is a silane gas note entire reference [sic]."

(Id.) While admitting that Maeda does not teach a SiC growth system comprising a graphite that is coated with a material having the properties recited in the appealed claims, the examiner nevertheless alleges that one of ordinary skill in the art would have combined the references to arrive at a method encompassed by the appealed claims. (Id.) Specifically, it is the examiner's position that "[i]t would have been obvious to

¹ The appellants submit that claims 34 through 36 and 48 through 50 should be considered together as a group. (Supplemental appeal brief filed Dec. 19, 2002, paper 24, p. 5.) While the appellants believe that claim 34 is representative of this group, we select claim 48 from this group of rejected claims and confine our discussion to this selected claim. 37 CFR § 1.192(c) (7) (1995) (effective Apr. 21, 1995).

one of ordinary skill in the art to modify the Maeda [] reference by the teachings of the Sugiyama [] and Balakrishna [] references to use of [sic] protective material in order to lower the chance of impurities in the grown crystals." (Id.)

We disagree. Appealed claim 1 and the other independent method claims, including claim 12 which is not rejected, recite, inter alia, the use of a silane and carbon source gas to form vaporized species containing carbon and silicon, which are then subjected to conditions suitable for crystal growth on the seed crystal. As pointed out by the appellants (supplemental appeal brief, page 6; reply brief filed May 12, 2003, paper 27, pages 1-3), none of the applied prior art references provide any teaching or suggestion of this claim limitation.

While the examiner argues that Maeda discloses that the silicon source is a silane gas (answer, page 3), we note that Maeda provides no indication that vaporized species containing carbon and silicon are formed by reacting silane and carbon source gas. Instead, Maeda (page 2, line 40 to page 3, line 5) teaches the formation of solid-phase SiC from the gaseous reactants in an apparatus quite unlike the one recited in the appealed claims.

Like Maeda, Balakrishna and Sugiyama are of no help to the examiner. Balakrishna and Sugiyama both teach the use of silicon reactant, not silane. (Balakrishna, page 2, line 31 to page 3, line 8; Sugiyama, column 1, lines 6-8.)

Because the examiner's proposed combination of references does not result in a method encompassed by the appealed claims, the rejection fails. It is clear, therefore, that the examiner has not carried the initial burden of establishing a prima facie case of obviousness within the meaning of 35 U.S.C. § 103(a).

Claims 34-36 and 48-50

Regarding the limitation "a graphite core from which a coating of a secondary material has been removed" in appealed claim 48, the specification explains that the coating may be removed "through use." (Page 12, line 26 to page 13, line 2.)

Balakrishna describes a SiC crystal growth system comprising a furnace system 30 (i.e., a container for receiving a SiC seed crystal), a source of Si 36, and a source of carbon-containing gas delivered through conduit 66. (Figure 2; page 5, line 3 to page 8, line 18.) According to Balakrishna, the device "includes a porous graphite wall 54 surrounded by graphite susceptor 56 and defining an interior growth cavity 58." (Page 5, lines 27-30.) In addition, Balakrishna teaches that "[i]n order to reduce the radial migration of potential

impurities into the growth cavity from the wall 54 or susceptor 56, a protective coating 60, of a high purity material such as silicon carbide or tantalum carbide, may be incorporated.”

(Page 5, lines 30-35.) Because tantalum carbide is described in the present specification as “exhibit[ing] the desired characteristics of the required coating” (specification, page 9, lines 17-26), we determine that Balakrishna describes each and every limitation of appealed claim 48.²

The appellants argue that Balakrishna does not suggest the recited thermal coefficient of expansion relationship between the graphite core and tantalum carbide. (Appeal brief filed Feb. 13, 2002, paper 19, page 11.) According to the appellants (id.), this is significant because “[g]raphite is a commercial material that may be ordered with specific coefficients of thermal expansion.” This argument lacks discernible merit, because the appellants have failed to identify the evidentiary basis in the record to support the allegation that graphite can have specific coefficients of thermal expansions that vary significantly.

² Although the examiner’s rejection of appealed claim 48 is made under 35 U.S.C. § 103(a), anticipation is the epitome of obviousness. See, e.g., In re McDaniel, 293 F.3d 1379, 1385, 63 USPQ2d 1462, 1466-67 (Fed. Cir. 2002).

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Summary

In summary, we reverse the examiner's rejection under 35 U.S.C. § 103(a) of appealed claims 1, 4 through 6, 8 through 10, 14 through 16, 18 through 24, 38, and 40 through 42 as unpatentable over Maeda in view of Balakrishna and Sugiyama. We affirm, however, the rejection of appealed claims 34 through 36 and 48 through 50 as unpatentable over the same combination of references.

The decision of the examiner is therefore affirmed in part.

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

AFFIRMED IN PART

CHARLES F. WARREN)	
Administrative Patent Judge)	
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)	BOARD OF PATENT
ROMULO H. DELMENDO)	
Administrative Patent Judge)	APPEALS AND
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)	INTERFERENCES
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