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## United States Court of Appeals for the Federal Circuit

00-1502

(Serial No. 08/088,001)

IN RE DANIEL R. PETRAK, GARY L. STARK, and GREGG A. ZANK

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DECIDED: May 25, 2001

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Before MICHEL, RADER, and BRYSON, Circuit Judges.

BRYSON, Circuit Judge.

Daniel Petrak, Gary Stark, and Gregg Zank (collectively "Petrak") appeal from an order of the Board of Patent Appeals and Interferences affirming the examiner's rejection of claims 1 through 6, 8 through 14, and 38 through 40 of Petrak's application, Serial No. 08/088,001, as obvious. Because substantial evidence supports the Board's underlying findings of fact and because the ultimate conclusion of obviousness based on those findings is not erroneous, we affirm.

### BACKGROUND

Petrak's claims are directed to an oxidation resistant ceramic composite. Claim 1 is representative of the rejected claims:

1. An oxidation resistant ceramic composite comprising:

a ceramic matrix formed by the ceramification of a preceramic composition comprising a curable preceramic polymer;

within the ceramic matrix, a refractory fiber coated with a material which provides an interface between the refractory fiber and the ceramic matrix; and

an in-situ formed sealant oxide coating on the surfaces of the composite exposed to the environment.

The examiner rejected claim 1 and other similar claims as obvious over Rice, U.S. Patent No. 4,642,271, in combination with Clark, U.S. Patent No. 4,746,480. The Board affirmed. It found that Rice discloses a ceramic matrix formed by the ceramification of a preceramic composition comprising a curable preceramic polymer and, within the matrix, a refractory fiber coated with a material that provides an interface between the refractory fiber and the ceramic matrix. The Board also found that Clark discloses an in-situ formed sealant oxide coating on the surfaces of ceramic fibers. Clark teaches that the use of such a coating contributes to the thermal stability of the fibers at high temperatures. The Board agreed with the examiner that one of skill in the art would read Clark to suggest that similar results could be obtained by using an in-situ formed sealant oxide coating on the surfaces of ceramic matrices consisting of material identical to the coated fibrous material of Clark. Finally, the Board found that motivation to combine Rice and Clark arose from the teachings of the references themselves and the level of skill in the art.

## DISCUSSION

Petrak argues that Rice and Clark do not disclose all the elements of the claimed invention. Specifically, Petrak complains that Rice does not explicitly teach the use of a "curable" preceramic polymer. The Board acknowledged that Rice does not recognize "curability" of the preceramic polymer as a prerequisite for preparing composites, but concluded that Rice teaches the use of polysilane, a curable preceramic polymer and a material preferred by Petrak. Petrak asserts that not all polysilanes are curable as that term is used in the specification, but Petrak does not point to any evidence supporting that assertion. On the contrary, substantial evidence supports the Board's finding that Rice discloses "a ceramic matrix formed by the ceramification of a preceramic composition comprising a curable preceramic polymer." Petrak's specification notes that curable preceramic polymers such as polysilane are "known in the art and can be manufactured by known techniques." Rice, in addition to specifically disclosing polysilane, makes clear that "[a] wide variety of ceramic matrix compositions may be used . . . ." Rice, col. 3, ll. 11-15. Finally, Clark states that "[o]rganosilicon preceramic polymers [such as polysilane] are well known in the art. Such polymers . . . can be cured and pyrolyzed to ceramic form." Clark, col. 3, ll. 40-44. This evidence is sufficient to support the Board's findings.

Petrak also argues that Clark does not disclose or teach the use of an in-situ formed sealant oxide coating on the surfaces of a composite as opposed to the surfaces of a fiber. Here, Petrak takes issue with the Board's reliance on the examiner's statement that "one of ordinary skill in the art would expect similar results [enhanced thermal stability] on a ceramic matrix surface consisting of material identical to the coated fibrous material of Clark." Petrak essentially contends that the claimed invention does not consist of "material identical to the

coated fibrous material of Clark." He concedes that Clark's fibers are made from the same polymer material as the claimed ceramic matrix. However, he asserts that there is no reasonable expectation that the composite (which also includes a coated refractory fiber) would react in the same manner as Clark's fiber. Petrak ignores the similarities between Clark's fiber and his claimed composite that underlie the Board's conclusion. Clark's fiber and the claimed composite are made from identical polymer materials; indeed, both Clark and Petrak recommend hydridopolysilazane as the preferred polymer material. Clark also notes that "organosilicon preceramic polymers are well-known in the art" and incorporates by reference other prior art references disclosing both ceramic fibers and matrices. Clark, col. 3, ll. 40-46. Although Clark's disclosure is directed at ceramic fibers, Clark also refers generally to "ceramic materials" and "ceramics made from organosilicon polymers" in discussing the background of his invention. See, e.g., Clark, col. 1, ll. 22, 33, 38. Thus, substantial evidence also supports the Board's finding that Clark teaches an in-situ formed sealant oxide coating on the surfaces of the composite exposed to the environment. All of the elements of the claimed invention are therefore disclosed in or taught by Rice and Clark.

Petrak further contends that the Board erred in finding a motivation to combine Rice and Clark. The Board adopted the examiner's reasoning that in order to provide enhanced thermal stability to the ceramic matrix in the composites of Rice, one of ordinary skill in the art would have been motivated to form an in-situ formed sealant oxide coating on the ceramic matrix surfaces similar to that on the fiber surfaces as taught by Clark. Rice discloses all of the elements of the claimed invention except the in-situ formed sealant oxide coating. Rice also discloses that exposure of his composite to high temperature oxidizing conditions may result in embrittlement. Rice, col. 5, ll. 5-7. Clark recognizes this very same embrittlement problem:

While ceramic fibers formed from organosilicon preceramic polymers are intended to be used in high temperature environments, it has often been found that when aged at high temperatures . . . these ceramic fibers are crystallized to an unusually brittle material whereby the thermal stability performance, i.e., change in weight and tensile properties, of the fiber are vastly degraded from original values.

Clark, col. 2, ll. 16-23. Clark's in-situ formed sealant oxide coating is offered as a solution to this problem: "It is another object of the present invention to provide thermally stable ceramic fibers from organosilicon preceramic polymers for use in high temperature, high performance applications." Clark, col. 2, ll. 33-36. As noted previously, the Board found that one of ordinary skill in the art would expect Clark's solution to achieve similar results on composite surfaces consisting of material identical to the coated fibrous material of Clark. Thus, Clark teaches the solution to the problem recognized by Rice. The motivation to combine arose "from the prior art as filtered through the knowledge of one skilled in the art." Motorola, Inc. v. Interdigital Tech. Corp., 121 F.3d 1461, 1472, 43 USPQ2d 1481, 1489 (Fed. Cir. 1997).

Petrak points to a comment in the Board's decision on reconsideration that the statute that addresses obviousness, 35 U.S.C. § 103, makes no reference to a motivation to combine. The Board, however, expressly found that a motivation to combine arose from the teachings of the references themselves and the level of skill in the art. Accordingly, its comments regarding 35 U.S.C. § 103 do not affect the correctness of its decision. Because the Board's finding as to the motivation to combine is supported by substantial evidence, we sustain the Board's conclusion that Petrak's claims are unpatentable as obvious.