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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte TAKAHIRO TOMITA, ASUMI JINDO, KENJI MORIMOTO, KEN KUWAMOTO, and KATSUHIRO INOUE

Appeal 2014-005493
Application 12/730,494
Technology Center 1700

Before TERRY J. OWENS, CATHERINE Q. TIMM, and AVELYN M. ROSS, *Administrative Patent Judges*.

TIMM, *Administrative Patent Judge*.

DECISION ON REQUEST FOR REHEARING

Appellants request rehearing of our Decision of August 9, 2016. In that Decision, we affirmed the Examiner's decision to reject claims 1, 3–10, and 14 under § 103(a) as obvious over Castillon in view of Katsuyoshi, as evidenced by Ketcham and Cutler.

In our Decision, we addressed two central issues, which we framed as follows:

> 1. Did the Examiner reversibly err in finding a suggestion within the prior art for incorporating copper oxide into the ceramic material of Castillon? And if not:
>
> 2. Did Appellants meet their burden of showing unexpected results commensurate in scope with the breath of claim 1 such that when all the evidence is weighed as a whole a preponderance supports a conclusion of non-obviousness?

Decision 2–3.

Appellants do not find fault with our framing of the issues. Request 1–4. Instead, Appellants contend that, in addressing the first issue on appeal, we misapprehended Appellants' explanation of the disclosure of Castillon found on page 7 of their Appeal Brief. Request 1. According to the Appeal Brief at page 7:

> It is readily apparent to one skilled in the art that, in Castillon, while the titania particles may undergo some sintering, the alumina particles do not. Attached hereto in the Evidence Appendix are excerpts from three very well-recognized textbooks in the field of ceramic engineering, and each of those excerpts shows that sintering occurs between particles that directly contact one another, wherein the original shape of the particles changes (i.e., grain growth occurs) and the porosity of the body decreases as sintering progresses (please see the check-mark portions of the attached excerpts). This is the type of sintering that occurs between the alumina particles described in the prior art section of Castillon at Col. 2, lines 17–22. This is not the type of sintering that is happening in the inventive section of Castillon, because the alumina particles do not even contact one another – again, each of the particles is fully enveloped by the titania bonding phase (see Castillon, Col. 3, lines 32–38). And, while the titania particles directly contact one another and may undergo some sintering, that sintering is insufficient in the absence of the copper oxide additive recited in the pending claims. Again, the copper oxide

> additive quadruples the flexural strength by improving the sinterability of the titania bonding phase.

Appeal Br. 7. We agree that Appellants were characterizing Castillon as describing *prior art* as teaching sintering that occurs between alumina particles, and that they were characterizing Castillon's inventive embodiment as void of sintering of alumina particles. Request 1. This, however, does not point to a reversible error in our Decision.

The issue, as we framed it in the Decision, is: "Did the Examiner reversibly err in finding a suggestion within the prior art for incorporating copper oxide into the ceramic material of Castillon?

Appellants had argued that the teachings of the references are not combinable because Castillon does not sinter the alumina particles of Castillon's inventive embodiment. Appeal Br. 7–8. Similarly to the Brief, Appellants argue in the Request that Castillon uses titania as a bonding agent between the alumina particles as an alternative to bonding alumina particles directly to each other. Request 2. Appellants acknowledge that Ketcham and Cutler teach using titania and copper oxide as sintering aids. *Id.* Appellants also contend that a bonding agent for alumina is different from a sintering aid for alumina. *Id.*

Appellants' argument against the combination of the reference teachings is not persuasive because Castillon does not use the term "bonding agent," nor have Appellants presented persuasive evidence showing that those of ordinary skill in the art would have recognized Castillon's titania as something other than a sintering aid. We note that Castillon teaches forming the raw or green monolith by forming a paste of titania and alumina powders, water, and other additives, in a way that permits coating each

alumina grain with a film of titania grains. Castillon, col. 3, ll. 12–50. Essentially, Castillon places grains of titania in and around grains of alumina. Because the titania has a melting point lower than alumina, the titania will completely melt during sintering heat treatment. *Id.* The sintering aids of Ketcham function in a similar manner. Ketcham teaches that the mechanism by which titania and copper oxide act as a sintering aid is based on evidence that titania and copper oxide form a eutectic liquid. Ketcham, col. 10, l. 66–col. 11, l. 5. In other words, titania and copper oxide form a melt at a lower temperature.

Appellants contend that "[o]nce the Board understands and accepts the fact that Castillon abandoned the notion of sintering the alumina particles, it is a foregone conclusion that Ketcham and Cutler are not combinable with Castillon, because the sintering aids disclosed in Ketcham and Cutler are specifically directed at sintering alumina particles." Request 2. We do not find this line of reasoning persuasive. There is no persuasive evidence that Castillon "abandoned the notion of sintering the alumina." *Id.* Castillon seeks to form a sintered, i.e., densified, monolithic support for a membrane, and the titania can be present in as little as 1 wt%. Castillon, col. 2, ll. 51–61. Given the low amount of titania that may be present, it would be necessary to sinter the alumina to make a viable monolithic support.

Thus, Appellants have not persuaded us that we reversibly erred in determining that "the evidence supports the Examiner's finding that those of ordinary skill in the art would have recognized that adding copper oxide would further lower the sintering temperature [of Castillon's green body containing alumina grains coated with a film of titania grains] given the teachings of Ketcham and Cutler." Decision 4.

In essence, we disagree with Appellants' reading of Castillon as suggesting sintering only the titania, and not the alumina within the green body. Castillon forms a monolithic ceramic support. *See* Castillon, col. 2, ll. 33–40 (referring to "a constituent ceramic material which can be shaped into a monolithic support and which can be sintered"). Whether the article is made of only alumina particles[1] or alumina particles coated with a film of titania particles, the shaped article is sintered, and must have the strength necessary to serve as a membrane support. Appellants have not established that direct contact between the alumina grains fails to occur in the method of Castillon's invention.[2]

A preponderance of the evidence supports a finding that sintering is occurring between all the ceramic particles of Castillon such that the entire body is densified and will hold together with the necessary strength to form the support. Ketcham and Cutler further support a finding that those of ordinary skill in the art would understand "sintering" to be referring to the overall densification of a particulate body whether or not the body contains additives such as titania and copper oxide. Ketcham, col. 1, ll. 5–35. Appellants' own evidence defines sintering as "[t]he densification of a particulate ceramic compact." Richerson, *Modern Ceramic Engineering, Properties, Processing, and Use in Design* § 7.1 ¶ 1 at p. 217 (1982). Other evidence cited by Appellants indicates that "[s]intered ceramic products

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[1] Castillon does not refer to alumina in the discussion of the prior art, but for discussion purposes it is sufficient to refer to the prior art monolithic ceramic support material as alumina.

[2] In Castillon's process, the titania grains in the film covering the alumina grains completely melt. Castillon, col. 3, ll. 34–39. It is not established that the melted titania grains would prevent contact between the alumina grains.

represent a wide range of material systems that may vary widely in the number of components, particle characteristics, complexity of chemical reactions, and densification mechanisms during sintering." Reed, *Principles of Ceramics Processing*, 2d. § 29.3 ¶ 1 at p. 594 (1995). Castillon's invention involves such densification of a ceramic product as do Ketcham and Cutler.

Appellants also respond to our discussion of the second issue on appeal, i.e., "[d]id Appellants meet their burden of showing unexpected results commensurate in scope with the breath of claim 1 such that when all the evidence is weighed as a whole a preponderance supports a conclusion of non-obviousness?" Request 2–4. Appellants, however, do not "state with particularity the points believed to have been misapprehended or overlooked" by us in rendering the Decision over and above those addressed above. 37 C.F.R. § 41.52 (2013). We addressed Appellants' arguments sufficiently in our Decision.

CONCLUSION

The subject Request has been granted to the extent that the Decision has been reconsidered, but denied with respect to making any changes therein. We affirm the decision of the Examiner to reject the claims.

DENIED