

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

BUBBLETIGHT, LLC,
Petitioner,

v.

BAKER HUGHES OILFIELD OPERATIONS, INC.,
Patent Owner.

Case IPR2017-00326
Patent 9,101,978 B2

Before JO-ANNE M. KOKOSKI, JON B. TORNQUIST, and
JEFFREY W. ABRAHAM, *Administrative Patent Judges*.

KOKOSKI, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
37 C.F.R. § 42.108

I. INTRODUCTION

Bubblight, LLC (“Petitioner”) filed a Petition (“Pet.”) to institute an *inter partes* review of claims 1–3, 7, 8, 10, 13–16, and 24–27 of U.S. Patent No. 9,101,978 B2 (“the ’978 patent,” Ex. 1001). Paper 1. Baker Hughes Oilfield Operations, Inc. (“Patent Owner”) filed a Preliminary Response (“Prelim. Resp.”). Paper 9. We have jurisdiction under 35 U.S.C. § 314.

Upon consideration of the Petition and Preliminary Response, we determine that Petitioner has not established a reasonable likelihood of prevailing with respect to the unpatentability of claims 1–3, 7, 8, 10, 13–16, and 24–27 of the ’978 patent. Accordingly, we deny the Petition and do not institute an *inter partes* review.

A. *Related Proceedings*

Petitioner indicates that the ’978 patent is asserted against it in *Baker Hughes Oilfield Operations, Inc. v. Bubblight, LLC*, No. 4:16-cv-1521 (S.D. Tex. 2016). Pet. 2; see Paper 7, 2. Petitioner states that it is also seeking *inter partes* review of U.S. Patent No. 8,573,295 B2, which incorporates by reference the subject matter of the ’978 patent. Pet. 2; see also Paper 7, 3 (identifying IPR2017-00327 as a related matter).

B. *The ’978 Patent*

The ’978 patent, titled “Nanomatrix Powder Metal Compact,” is directed to “[l]ightweight, high-strength metallic materials” that may be used “in various wellbore environments to make various selectably and controllably disposable or degradable lightweight, high-strength downhole tools or other downhole components.” Ex. 1001, 3:61–66. The described metallic materials “include fully-dense, sintered powder compacts formed from coated powder materials that include various lightweight particle cores

and core materials having various single layer and multilayer nanoscale coatings.” *Id.* at 4:2–6. The powder compacts are made from coated metallic powders that include various electrochemically-active, lightweight, high-strength particle cores and core materials “that are dispersed within a cellular nanomatrix formed from the various nanoscale metallic coating layers of metallic coating materials.” *Id.* at 4:6–13.

Figure 1 is reproduced below.

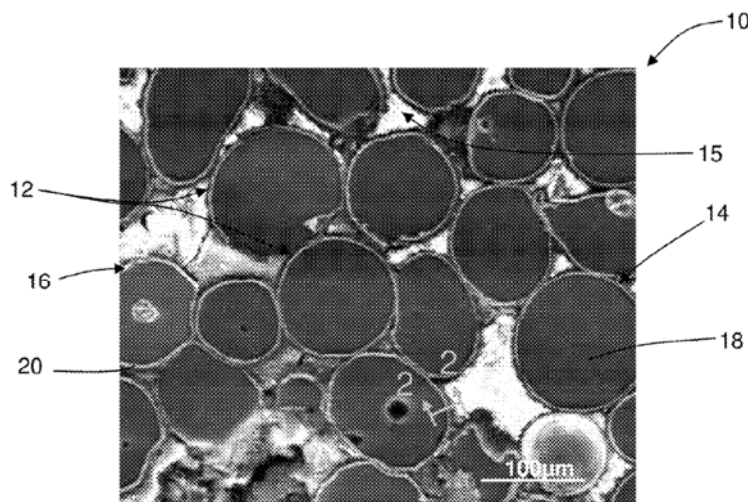


FIG. 1

Figure 1 is a photomicrograph of a powder as described in the '978 patent “that has been embedded in an epoxy specimen mounting material and sectioned.” *Id.* at 2:47–49. Metallic powder 10 comprises a plurality of metallic, coated powder particles 12. *Id.* at 4:46–47. Each powder particle 12 includes particle core 14 (comprising core material 18), with coating layer 16 disposed on particle core 14. *Id.* at 4:56–59. Examples of core material 18 include “electrochemically active metals having a standard oxidation potential greater than or equal to that of Zn,” such as Mg, Al, Mn, or Zn, or a combination thereof. *Id.* at 4:63–66. “Core material 18 may also include other metals that are less electrochemically active than Zn or non-

metallic materials, or a combination thereof,” where “[s]uitable non-metallic materials include ceramics, composites, glasses or carbon, or a combination thereof.” *Id.* at 5:6–10.

Metallic coating layer 16 comprises metallic coating material 20, and “is a nanoscale coating layer” that “may have a thickness of about 25 nm to about 2500 nm.” *Id.* at 6:26–31. Metallic coating layer 16 may be a single layer, or a plurality of layers in a multilayer coating structure. *Id.* at 6:34–37. Metallic coating material 20 is chosen to “provide[] a sinterable outer surface 21 that is configured to be sintered to an adjacent powder particle 12 that also has a metallic coating layer 16 and sinterable outer surface 21.” *Id.* at 7:8–12.

Figure 9 is reproduced below.

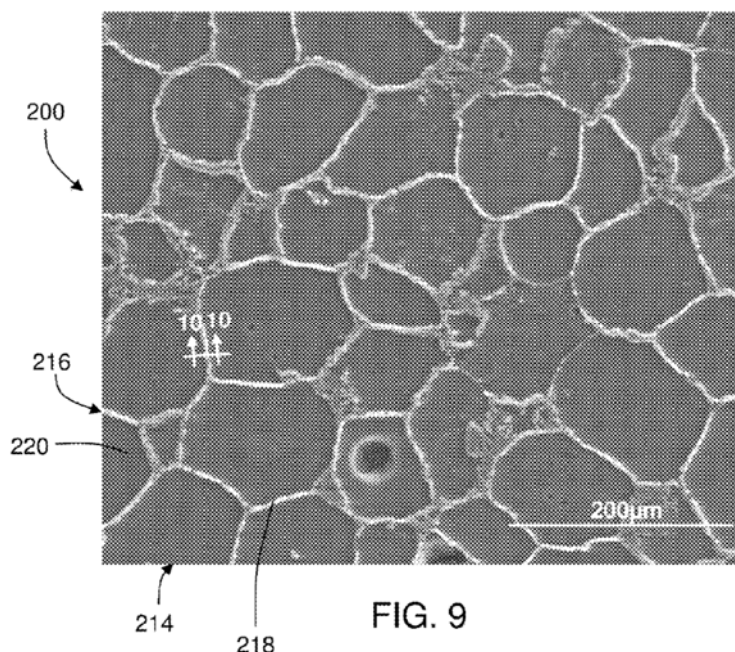


FIG. 9

Figure 9 is “a photomicrograph of an exemplary embodiment of a powder compact as disclosed” in the ’978 patent. *Id.* at 3:6–7. Powder compact 200 includes substantially-continuous, cellular nanomatrix 216, which is

comprised of nanomatrix material 220 having a plurality of dispersed particles 214 dispersed throughout nanomatrix 216. *Id.* at 11:47–51. “The substantially-continuous cellular nanomatrix 216 and nanomatrix material 220 formed of sintered metallic coating layers 16 is formed by the compaction and sintering of the plurality of metallic coating layers 16 of the plurality of powder particles 12” shown in Figure 1. *Id.* at 11:51–55. Dispersed particle cores 214 (comprising core material 218) “correspond to and are formed from the plurality of particle cores 14 and core material 18 of the plurality of powder particles 12 as the metallic coating layers 16 are sintered together to form nanomatrix 216.” *Id.* at 11:60–64.

Figure 10 is reproduced below.

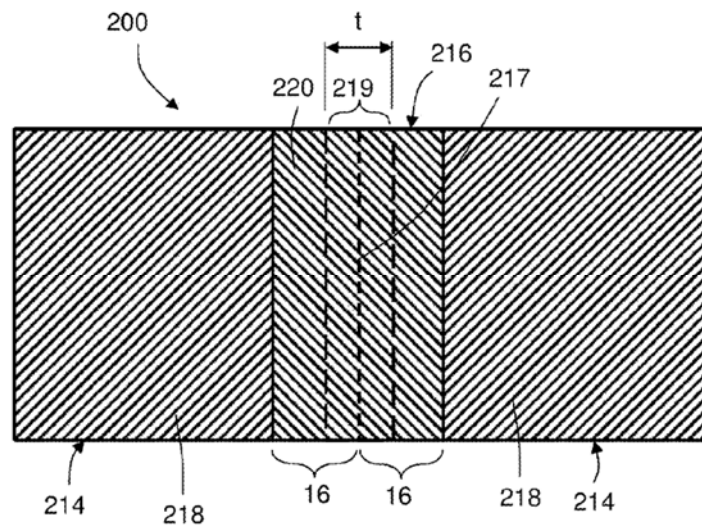


FIG. 10

Figure 10 is a schematic illustration of powder compact 200 in Figure 9, “made using a powder having single-layer coated powder particles as it would appear” along section 10–10 in Figure 9. *Id.* at 3:8–11. Nanomatrix 216 includes solid-state metallurgical bond 217 or bond layer 219 “extending between the dispersed particles 214 throughout the cellular nanomatrix 216 that is formed at a sintering temperature (T_s).” *Id.* at 13:13–

17. Solid-state bond layer 219 “has a thickness (t) defined by the extent of the interdiffusion of the coating materials 20 of the coating layers 16, which will in turn be defined by the nature of the coating layers 16.” *Id.* at 13:24–27.

The ’978 patent explains that “[d]ifferences in the chemical compositions of coating material 20 and core material 18 may be selected to provide different dissolution rates and selectable and controllable dissolution of powder compacts 200 that incorporate them making them selectably and controllably dissolvable.” *Id.* at 7:42–47. “This includes dissolution rates that differ in response to a changed condition in the wellbore” such as “a change in temperature, change in pressure, change in flow rate, change in pH or change in chemical composition of the wellbore fluid, or a combination thereof.” *Id.* at 7:47–57. “The selectable dissolution response to the changed condition may result from actual chemical reactions or processes that promote different rates of dissolution, but also encompass changes in the dissolution response that are associated with physical reactions or processes, such as changes in wellbore fluid pressure or flow rate.” *Id.* at 7:57–62.

C. Challenged Claims

Petitioner challenges claims 1–3, 7, 8, 10, 13–16, and 24–27 of the ’978 patent. Independent claims 1 and 25 are representative, and are reproduced below.

1. A powder metal compact, comprising:
 - a substantially-continuous, cellular nanomatrix comprising a nanomatrix material;
 - a plurality of dispersed particles comprising a particle core material that comprises Mg, Al, Zn, or Mn, or a

combination thereof, dispersed in the cellular nanomatrix;
and

- a solid-state bond layer extending throughout the cellular nanomatrix between the dispersed particles, the powder metal compact comprising deformed powder particles formed by compacting powder particles comprising a particle core and at least one coating layer, the coating layers joined by solid-state bonding to form the substantially-continuous, cellular nanomatrix and leave the particle cores as the dispersed particles.

Ex. 1001, 24:15–28.

25. A powder metal compact, comprising:

- a substantially-continuous, cellular nanomatrix comprising a nanomatrix material;
- a plurality of dispersed particles comprising a particle core material that comprises a metal having a standard oxidation potential less than Zn, ceramic, glass, or carbon, or a combination thereof, dispersed in the cellular nanomatrix; and
- a solid-state bond layer extending throughout the cellular nanomatrix between the dispersed particle, the powder metal compact comprising deformed powder particles formed by compacting powder particles comprising a particle core and at least one coating layer, the coating layers joined by solid-state bonding to form the substantially-continuous, cellular nanomatrix and leave the particle cores as the dispersed particles.

Id. at 26:24–39.

D. The Prior Art

Petitioner relies on the following prior art references:

Reference	Description	Date	Exhibit No.
Toth	US 6,372,346 B1	Apr. 16, 2002	1008
Baker	US 8,535,604 B1	Sept. 17, 2013	1006

Reference	Description	Date	Exhibit No.
Xie	<i>TEM Observation of Interfaces between Particles in Al-Mg Alloy Powder Compacts Prepared by Pulse Electric Current Sintering</i> , MATERIALS TRANSACTIONS, Vol. 43, No. 9, 2177–2180	2002	1007

E. The Asserted Grounds of Unpatentability

Petitioner challenges the patentability of claims 1–3, 7, 8, 10, 13–16, and 24–27 on the following grounds:

Reference(s)	Basis	Challenged Claims
Baker	§ 102(e)	1–3, 7, 8, 10, 13–16, 24–27
Baker and Xie	§ 103(a)	1–3, 7, 8, 10, 13–16, 24–27
Baker and Toth	§ 103(a)	1–3, 7, 8, 10, 13–16, 24–27

II. ANALYSIS

A. Claim Interpretation

We interpret claims of an unexpired patent using the “broadest reasonable construction in light of the specification of the patent in which [the claims] appear[.]” 37 C.F.R. § 42.100(b); *see Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016). Consistent with the broadest reasonable construction, claim terms are presumed to have their ordinary and customary meaning as understood by a person of ordinary skill in the art in the context of the entire patent disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). However, a “claim term will not receive its ordinary meaning if the patentee acted as his own lexicographer and

clearly set forth a definition of the disputed claim term in either the specification or prosecution history.” *CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1366 (Fed. Cir. 2002). Only those terms in controversy need to be construed, and only to the extent necessary to resolve the controversy. *See Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

For purposes of this Decision, based on the record before us, we address the interpretation of the claim term “substantially-continuous, cellular nanomatrix” as set forth in claims 1 and 25.

1. “*substantially-continuous, cellular nanomatrix*”

Claims 1 and 25 recite, in relevant part, “a substantially-continuous, cellular nanomatrix comprising a nanomatrix material.” Petitioner proposes that we interpret “substantially-continuous” to mean “extending between and enveloping most but not necessarily all of the dispersed particles,” “cellular” to mean “generally repeating, interconnected and compartmental,” and “nanomatrix” to mean “network of material of nanoscale thickness in the powder metal compact.” Pet. 10–11. Patent Owner responds that “no construction of these terms is necessary,” but states that “even under Petitioner’s constructions, Petitioner has not shown that the prior art renders any claims of the 978 patent unpatentable.” Prelim. Resp. 7–8.

As Petitioner notes, the ’978 patent specification addresses the definition of the term “substantially-continuous, cellular nanomatrix.” Pet. 10–12. The Specification explains, with reference to Figure 9, that

[t]he use of the term substantially-continuous, cellular nanomatrix is intended to describe the extensive, regular, continuous and interconnected nature of the distribution of nanomatrix material 220 within powder compact 200. As used herein, “substantially-continuous” describes the extension of the

nanomatrix material throughout powder compact 200 such that it extends between and envelopes substantially all of the dispersed particles 214. Substantially-continuous is used to indicate that complete continuity and regular order of the nanomatrix around each dispersed particle 214 is not required.

Ex. 1001, 12:7–17. The Specification further states that,

[a]s used herein, ‘cellular’ is used to indicate that the nanomatrix defines a network of generally repeating, interconnected, compartments or cells of nanomatrix material 220 that encompass and also interconnect the dispersed particles 214. As used herein, ‘nanomatrix’ is used to describe the size or scale of the matrix, particularly the thickness of the matrix between adjacent dispersed particles 214.

Id. at 12:24–31.

Based on these disclosures, we determine that the patentee acted as its own lexicographer and defined the term “substantially-continuous, cellular nanomatrix” to mean “a nanoscale-thick network of generally repeating, interconnected compartments or cells that encompass and interconnect the dispersed particles by extending between and enveloping substantially all of the dispersed particles. Complete continuity and regular order around each dispersed particle is not required.” An example of the claimed “substantially-continuous, cellular nanomatrix” is depicted in Figure 9 of the Specification.

Therefore, for purposes of this Decision and in accordance with the broadest reasonable interpretation in light of the specification, we interpret “substantially-continuous, cellular nanomatrix” to mean “a nanoscale-thick network of generally repeating, interconnected compartments or cells that encompass and interconnect the dispersed particles by extending between

and enveloping substantially all of the dispersed particles. Complete continuity and regular order around each dispersed particle is not required.”

B. Anticipation by Baker

Petitioner contends that the subject matter of claims 1–3, 7, 8, 10, 13–16, and 24–27 is unpatentable under 35 U.S.C. § 102(e) as anticipated by Baker. Pet. 19–35. Petitioner relies on the Declaration of Karl T. Hartwig (“the Hartwig Declaration,” Ex. 1009) in support of its contentions. *Id.*

1. Overview of Baker

Baker is directed to “a method of producing composites of micro-engineered, coated particulates embedded in a matrix of metal, ceramic powders, or combinations thereof.” Ex. 1006, Abs. The composites described by Baker are “capable of being tailored to exhibit application-specific desired thermal, physical and mechanical properties.” *Id.* In particular, Baker describes a method that includes the steps of (1) selecting at least one micro-engineered particulate, (2) mixing the chosen particulate(s) with a powder substrate, (3) pre-consolidating the mixed powder to form a near net shape article, and (4) consolidating the near net shape article with a heat and pressure application in a solid state process to produce a metal matrix composite. *Id.* at 2:30–38.

Baker Figures 1 and 2 are reproduced below.

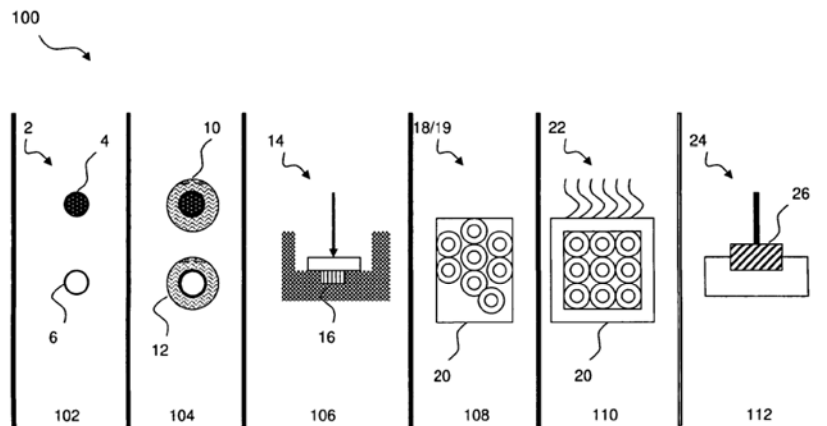


Fig. 1

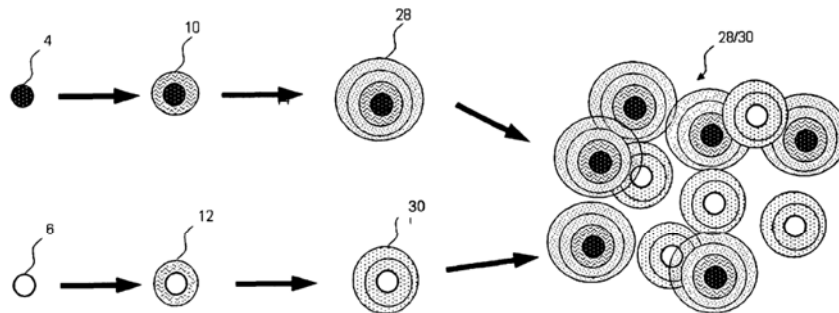


Fig. 2

Figure 1 is a schematic drawing of the steps in Baker's method of producing property-specific metal matrix composites. *Id.* at 3:26–28. Figure 2 is a schematic drawing of steps 102–104 shown in Figure 1. *Id.* at 3:29–30, 7:38–39. In step 102, particulates 2, which may comprise solid microspheres (powders) 4 and hollow microspheres 6, are selected depending on the specific properties desired in the final composite. *Id.* at 5:30–32, 7:39–42. “Particulate materials include, but are not limited to, one

or more, metals, alloys, ceramics, and/or elements from Groups 1 through 15 of the Periodic Table of the Elements.” *Id.* at 5:42–45.

In step 104, powders 4 and spheres 6 are coated with single or multiple layers of ceramics, metals, or elements, to produce coated powders 10 and coated spheres 12. *Id.* at 5:47–49, 7:45–48. Exemplary coating materials include carbon, lead, tungsten, rhenium, tantalum, niobium, and boron. *Id.* at 5:53–56. “The coatings are shown enlarged in FIG. 2 and are not drawn to scale; the actual coating thickness ranges from approximately 5 nanometers to 20 microns.” *Id.* at 7:50–52. Multiple coating layers can be applied to powders 4 and spheres 6 “to form solids having multiple coatings 28 and spheres having multiple coatings 30.” *Id.* at 7:62–64. After powders 28 and microspheres 30 “are coated with the desired layers, the powders 28 and microspheres 30 are mixed to form the micro-engineered particulates 28/30 ready for use in consolidation.” *Id.* at 8:3–6.

In step 106, “particulates 2 are combined with a powder substrate to form a nano design powder that is subjected to a pre-consolidation 14 process for creation of a near net shape article 16.” *Id.* at 5:64–67. Specifically, “the selected micro-engineered particulates 4/6/10/12/28/30 are combined and mixed with the powder substrate 34 (coated or not coated) to form a nano design powder 32 (shown in FIG. 4) ready for consolidation.” *Id.* at 8:47–51. Suitable powder substrate materials include, among others, metals, alloys, polymers, ceramics, and elements from Groups 1 through 15 of the Periodic Table of the Elements (including lithium, magnesium, titanium, rhenium, and tantalum). *Id.* at 6:4–8. The powder substrate materials also can “be coated with one or more layers of materials selected

from the group consisting of metals, alloys, elements, polymers and/or ceramics.” *Id.* at 6:27–30.

In step 108, “the near net shape article is consolidated 18/19 to form a metal matrix composite 20 having increased density over the pre-consolidation step, and uniformity to the desired level appropriate for the specific composition and desired application.” *Id.* at 6:40–44. The strength, microstructure, and density of metal matrix composite 20 “is determined by both the composite formulation and processing route used for consolidation 18/19.” *Id.* at 6:44–47. In step 110, composite 20 can be subjected to post-consolidation processing 22, the primary goal of which is to increase and control the ductility and other properties of the final parts. *Id.* at 7:5–12. In step 112, composite 20 is processed to form an article having final desired shape 26. *Id.* at 7:14–18.

Baker also describes an alternate embodiment in which “the selected micro-engineered particulates 4/6/10/12/28/30 are consolidated without use of a powder substrate 34.” *Id.* at 8:51–54; *see id.* at 14:16–30. Baker teaches that the alternate method includes the steps of (1) “selecting at least one micro-engineered particulate,” (2) “coating the particulate with at least one material selected from the group consisting of metals, alloys, element[s], polymers and ceramics,” (3) “inserting the particulate into a form,” and (4) “forging, sintering or consolidating the particulate to form a composite.” *Id.* at 14:18–24. According to Baker, “[d]epending on the level of pressure applied during consolidation or Dynamic Forging 18/19, the composite may have varying levels of porosity,” and, where hollow particulates are used, “the Dynamic Forging 18/19 process may be utilized to controllably crush a

desired approximate percentage of particulates to form a less porous composite.” *Id.* at 14:24–30.

2. *Analysis*

Petitioner asserts that Baker discloses all of the elements of independent claims 1 and 25. Pet. 19–27. For example, Petitioner contends that Baker discloses “a substantially-continuous, cellular nanomatrix comprising a nanomatrix material” because it describes an embodiment where the “the metal matrix is formed solely from solid particles that are coated with metals or alloys” and “are consolidated without a powder substrate.” *Id.* at 20 (citing¹ Ex. 1006, 7:28–31, 8:14–18, 7:45–46, 8:51–54). Petitioner contends that Baker “specifically discloses coating layers that are []1 nanometer to 20 microns thick,” and, “[o]n at least the lower end of the disclosed ranges, these coating thicknesses are nanoscale.” *Id.* (citing Ex. 1006, 5:47–50; Ex. 1009 ¶ 57).

Petitioner points to step 108 of Baker Figure 1 as illustrating “the generally repeating, interconnected and compartmental nature of the materials that surround the coated particles 10 after consolidation and creation of the metal matrix composite” to support its contention that the Baker nanomatrices are “cellular.” *Id.* at 21 (citing Ex. 1006, Fig. 1; Ex. 1009 ¶ 58). Petitioner also contends that Baker Figure 1 “illustrates that the network material extends between and envelops all of the dispersed particles

¹ Petitioner’s liberal use of “*id.*” in its citations, particularly where the previous reference is not immediately visible, resulted in several instances where the previous reference does not support the quotation or contention presented by Petitioner. Because the cited exhibit is identifiable from the surrounding text, we are convinced that the errors are typographical and we correct these errors when referring to the cited disclosures.

in the composite” because “Baker states that ‘powder particles 32 are re-aligned and packed into tighter configuration than as existed in the preform 16, thereby partially filling interstitial vacancies,’” and “[t]he process of filling interstitial vacancies ensures the ‘nanomatrix’ is ‘substantially continuous.’” *Id.* at 21–22 (citing Ex. 1006, 9:23–27, Fig. 1; Ex. 1009 ¶ 59).

Patent Owner responds that Baker “discloses two types of powder compact materials,” a first that “uses a separate substrate powder to form a matrix between dispersed coated particles,” and a second that “uses the coatings on the particles to form a matrix.” Prelim. Resp. 1–2. Patent Owner argues that Petitioner relies on the second embodiment “in which ‘the metal matrix composite is formed solely from solid particles that are coated with metals or alloys,’ *i.e.*, Baker’s coating-only ‘Alternate Embodiment’” as generally disclosing “a substantially-continuous cellular nanomatrix.” *Id.* at 14 (citing Pet. 20). However, “in addressing whether Baker discloses a ‘*substantially continuous*’ matrix,” Patent Owner argues that “Ppetitioner switches to relying on [a] disclosure that relates only to the distinct substrate-matrix embodiment,” *i.e.*, Baker’s embodiment that includes a separate, additional powder substrate. *Id.* According to Patent Owner, Petitioner does not identify any “express disclosure in Baker of the microstructure of Baker’s coating-only embodiment, nor in particular any disclosure that it would possess the recited ‘*substantially-continuous*’ matrix,” and does not establish “that Baker’s coating-only embodiment would necessarily produce a matrix that does not have significant breaks or gaps.” *Id.* at 15.

We are not persuaded that Petitioner has established that Baker teaches a “substantially-continuous, cellular nanomatrix” as recited in claims

1 and 25. As Patent Owner notes (Prelim. Resp. 14), Petitioner relies on Baker's disclosure that "powder particles 32 are re-aligned and packed into a tighter configuration than as existed in the preform 16, thereby partially filling interstitial vacancies" as teaching a substantially-continuous nanomatrix. Pet. 21 (quoting Ex. 1001, 9:23–27). As described by Baker, powder 32 comprises "the micro-engineered particulates (4/6/10/12/28 and/or 30 as shown in FIG. 2) *combined with the powder substrate* (34 as shown in FIG. 3E)." Ex. 1006, 9:3–6 (emphasis added). Petitioner, however, relies on Baker's alternate embodiment, which does not use a powder substrate, as disclosing a nanomatrix comprising a nanomatrix material. See Pet. 20 ("In one embodiment, the metal matrix composite is formed solely from solid particles that are coated with metals or alloys. The particles are consolidated without a powder substrate." (internal citations omitted)). Thus, Petitioner is relying on two separate embodiments described in Baker as disclosing the limitations of claims 1 and 25.

The two embodiments upon which Petitioner relies are incompatible with one another. One embodiment discloses using a powder substrate to form a matrix between the dispersed particulates (*see, e.g.*, Ex. 1006, 9:3–19), and the other discloses forging, consolidating, or sintering the dispersed particulates to form a composite without the use of a powder substrate (*id.* at 14:16–24). Accordingly, Petitioner's anticipation argument with respect to Baker requires combining disclosures from separate embodiments. This is not a permissible way to argue anticipation. "[I]t is not enough that the prior art reference . . . includes multiple, distinct teachings that the artisan might somehow combine to achieve the claimed invention." *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1371 (Fed. Cir. 2008). "[U]nless a reference

discloses within the four corners of the document not only all of the limitations claimed but also all of the limitations arranged or combined in the same way as recited in the claim, it cannot be said to prove prior invention of the thing claimed” and, therefore, “cannot anticipate under 35 U.S.C. § 102.” *Id.* Instead, Petitioner appears to be arguing that a person of ordinary skill in the art would somehow combine the separate disclosures in Baker’s two embodiments, which cannot support a case of anticipation.

If Petitioner is arguing, however, that Baker’s alternate, powderless embodiment would inherently produce a substantially-continuous, cellular nanomatrix, that argument also fails. Inherent anticipation applies when the missing element is necessarily present in the recited reference. *See In re Montgomery*, 677 F.3d 1375, 1379–80 (Fed. Cir. 2012) (“A reference may anticipate inherently if a claim limitation that is not expressly disclosed ‘is necessarily present, or inherent, in the single anticipating reference.’” (quoting *Verizon Servs. Corp. v. Fibernet Va., Inc.*, 602 F.3d 1325, 1337 (Fed. Cir. 2010))). Thus, based on our construction of “substantially-continuous, cellular nanomatrix” set forth above, Petitioner must show that a nanoscale-thick network of generally repeating, interconnected compartments or cells that encompass and interconnect the dispersed particles by extending between and enveloping substantially all of the dispersed particles is necessarily present in Baker. Neither Petitioner nor Dr. Hartwig sufficiently demonstrates that Baker’s powderless, alternate embodiment would invariably include “a substantially-continuous, cellular nanomatrix” as required by claims 1 and 25 of the ’978 patent.

Specifically, Petitioner and Dr. Hartwig point to Baker’s description of step 108 in Figure 1 that the interstitial vacancies are “partially” filled

when the powder particles are re-aligned and packed into a tighter configuration to support the contention that “[t]he process of filling interstitial vacancies ensures the ‘nanomatrix’ is ‘substantially continuous.’” Pet. 21–22 (citing Ex. 1009 ¶ 59). According to the ’978 patent, however, “substantially-continuous” means that the nanomatrix material extends between and envelops substantially all of the dispersed particles, and that complete continuity and regular order around each dispersed particle is not required, as demonstrated in Figure 9 of the Specification. Petitioner and Dr. Hartwig do not explain how *partially* filling the interstitial vacancies, as Baker teaches, invariably results in a substantially-continuous, cellular nanomatrix.

Moreover, neither Petitioner nor Dr. Hartwig addresses how Baker’s Figure 1 embodiment, which includes a powder substrate that can occupy the interstitial vacancies, demonstrates that the coated particulates in Baker’s powderless alternate embodiment also would at least partially fill the interstitial vacancies. As Patent Owner notes, Baker’s alternate embodiment contemplates “that the particles may have ‘varying levels of porosity’ depending on the level of pressure applied and that a desired amount of the coated particles may be crushed (which would, in turn, result in breaking the coating, making it discontinuous).” Prelim. Resp. 15 (citing Ex. 1006, 14:16–31). We also find Patent Owner’s argument that “if a coating material with high compressive strength is used, the coating may not deform to fill the interstitial spaces, resulting in a matrix with significant gaps between the dispersed particles” to be persuasive. *Id.* at 15–16.

Petitioner and Dr. Hartwig also rely on step 108 of Baker Figure 1 to establish that the Baker nanomatrices are “cellular.” Pet. 21; Ex. 1009 ¶ 58. Specifically, Dr. Hartwig testifies that

[t]he nanomatrices disclosed by Baker are also “cellular” as that term is used in the ’978 patent and would have been understood by a [person having ordinary skill in the art]. For example, step 108 of Figure 1 illustrates the generally repeating, interconnected and compartmental nature of the materials that surround the coated particles 10 after consolidation and creation of the metal matrix composite. Ex. 1006, Fig. 1.

Ex. 1009 ¶ 58; *see also* Pet. 21 (same). As Patent Owner notes, however, Baker Figure 1 “is a schematic of the processing steps for making a composite—not a to-scale representation of the microstructure of the resulting composite material.” Prelim. Resp. 17. Additionally, Baker states that in step 108 of Figure 1, “[t]he resulting strength, microstructure and density of the composite 20 is determined by both the composite formulation and processing route used for consolidation 18/19.” Ex. 1006, 6:40–47. Thus, contrary to Petitioner’s and Dr. Hartwig’s contention, step 108 of Baker Figure 1 does not teach anything about the specific microstructure of the Baker composites. Instead, Baker’s description of Figure 1 demonstrates that the properties of the composite (including the microstructure) depend on a number of factors that are not depicted in the schematic drawing. Neither Petitioner nor Dr. Hartwig provides any objective evidence or explanation as to how or why a person having ordinary skill in the art would understand that step 108 in Baker Figure 1 discloses, expressly or inherently, a substantially-continuous cellular nanomatrix as required by claims 1 and 25. Dr. Hartwig’s unsupported and unexplained opinions are not persuasive.

Accordingly, we conclude that Petitioner has not demonstrated a reasonable likelihood that independent claim 1, and claims 2, 3, 7, 8, 10, 13–16, and 24 that depend, directly or indirectly, therefrom, and independent claim 25, and claims 26 and 27 that depend directly therefrom, are anticipated by Baker.

3. *Obviousness over Baker*

In its identification of the grounds of its challenge, Petitioner states that “[e]ach of the challenged claims is anticipated by, *or at least obvious over,*” Baker. Pet. 4 (emphasis added); *see also id.* at 19 (“[T]he challenged claims are anticipated by, or at least obvious to a [person having ordinary skill in the art] over, Baker.”). Petitioner, however, does not present any arguments relating to its contention that claims 1–3, 7, 8, 10, 13–16, and 24–27 would have been obvious over Baker. Challenging claims under an obviousness alternative to anticipation does not relieve Petitioner of the burden of articulating “reasoning with rational underpinning” to show obviousness. *KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398, 418 (2007) (quoting *In re Kahn*, 551 F.3d 977, 988 (Fed. Cir. 2006)). On this record, Petitioner has not demonstrated a reasonable likelihood that it would prevail on the ground that Baker renders the subject matter of claims 1–3, 7, 8, 10, 13–16, and 24–27 obvious.

C. *Other Grounds*

Petitioner contends that, if the Board does not find that the subject matter of claims 1–3, 7, 8, 10, 13–16, and 24–27 are anticipated by Baker, the claims would have been unpatentable as obvious over the combined teachings of Baker and Xie, or Baker and Toth. Pet. 35–41. Petitioner does not rely on Xie or Toth to remedy the deficiencies in Baker described above

with respect to the “substantially-continuous, cellular nanomatrix” limitation of claims 1 and 25. *See id.* Consequently, Petitioner has not demonstrated a reasonable likelihood that it would prevail in showing that independent claim 1, and claims 2, 3, 7, 8, 10, 13–16, and 24 that depend, directly or indirectly, therefrom, and independent claim 25, and claims 26 and 27 that depend directly therefrom, would have been obvious over the combined teachings of Baker and Xie, or Baker and Toth.

III. CONCLUSION

Based on the arguments in the Petition and the Preliminary Response, and the evidence of record, we determine that Petitioner has not established a reasonable likelihood that it would prevail on its challenge that claims 1–3, 7, 8, 10, 13–16, and 24–27 of the ’978 patent are unpatentable.

IV. ORDER

In consideration of the foregoing, it is hereby
ORDERED that the Petition is *denied*.

IPR2017-00326
Patent 9,101,978 B2

PETITIONER:

Michael J. Collins
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