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Paper 45
Entered: March 25, 2015

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LAIRD TECHNOLOGIES, INC.,
Petitioner

v.

GRAFTECH INTERNATIONAL HOLDINGS, INC.,
Patent Owner.

Case IPR2014-00025
Patent 7,292,441 B2

Before BRIAN J. McNAMARA, BARRY L. GROSSMAN, and J. JOHN LEE, *Administrative Patent Judges*.

GROSSMAN, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. INTRODUCTION

Laird Technologies, Inc. ("Petitioner") filed a Corrected Petition requesting an *inter partes* review of claims 1–16 of U.S. Patent No. 7,292,441 B2 ("the '441 patent"). Paper 5 ("Pet."). On March 26, 2014, we instituted an *inter partes* review under 35 U.S.C. § 103 for obviousness of:

A. claims 1, 4, 5, 10-12, 14, and 15 over Norley (Ex. 1021), Tzeng '520 (Ex. 1004), Mercuri (Ex. 1023), and Admitted Prior Art ("APA");

B. claims 2, 3, 8, and 9 over Norley, Tzeng '520, Mercuri, APA, and Richey (Ex. 1018);

C. claim 6 over Norley, Tzeng '520, Mercuri, APA, and Tzeng '076 (Ex. 1020);

D. claim 7 over Norley, Tzeng '520, Mercuri, APA, Tzeng '076, and the Kapton Website (Ex. 1017);

E. claim 13 over Norley, Tzeng '520, Mercuri, APA, and Mendolia (Ex. 1031); and

F. claim 16 over Norley, the eGraf Technical Bulletin, Tzeng '520, Mercuri, APA, and Chauvel (Ex. 1032).

See Decision on Institution of Inter Partes Review, Paper 9 ("Dec. to Inst.").

GrafTech International Holdings, Inc. ("Patent Owner") filed a Confidential Patent Owner Response (Paper 21, "Confidential PO. Resp.") and a Redacted Patent Owner Response (Paper 20, "Redacted PO Resp."). Petitioner filed a Reply (Paper 28, "Reply").

We granted Patent Owner's motion to seal Exhibits 2034–2040, 2047, 2053–2063, 2074–2091 (collectively the "Sealed Exhibits") and portions of the Patent Owner Response. Paper 27.

Patent Owner did not file a motion to amend the claims.

Also before us is Patent Owner's Motion to Exclude Evidence (Paper 34, "Mot. Excl."), Petitioner's Opposition to the Motion (Paper 38, "Resp. to Mot. Excl."), and Patent Owner's Reply (Paper 40, "Reply Mot. To Excl."); as well as Patent Owner's Observations on the Cross Examination of Richard Feinberg (Paper 35), and Petitioner's Response to Patent Owner's Observations (Paper 37).

An oral hearing was held on December 15, 2014. A transcript of the hearing is included in the record. Paper 44 ("Tr.").

We have jurisdiction under 35 U.S.C. § 6(c). This final written decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73.

For the reasons that follow, we determine Petitioner has shown by a preponderance of the evidence that claims 1–16 are unpatentable.

A. The '441 patent

The invention in the challenged claims of the '441 patent relates generally to a heat dissipating and heat shielding system for electronic components, and specifically for a cell phone. Ex. 1001, col. 3, ll. 51-55, col. 16, ll. 63-67. The system uses a "thermal solution" to provide the heat dissipating and heat shielding functions. *Id.* at col. 3, ll. 55-60. The "thermal solution" is an anisotropic sheet of compressed particles of exfoliated graphite.[1] *Id.* The '441 patent also refers to this material as "flexible graphite." *Id.* As defined in the '441 patent, the term "flexible graphite" and, thus, CPEG generally, also refer to sheets of pyrolytic graphite, either singly or as a laminate. *Id.* Consistent with the well-known properties of anisotropic materials, the flexible graphite sheet employed as

[1] Compressed particles of exfoliated graphite are referred to generally by the acronym "CPEG." Redacted PO Resp. 1.

the thermal solution in the invention claimed in the ’441 patent has an in-plane thermal conductivity substantially higher than its through-plane thermal conductivity. *Id.* at col. 3, ll. 60-63.

Anisotropic materials preferentially transfer heat in selected directions. Ex. 1001, col. 2, ll. 2–4. The thermal anisotropy of a material is defined by the material’s in-plane and through-plane thermal conductivities. Ex. 2005 ¶ 72. As shown in the figures below, “in-plane” refers to the “a” direction and runs along the length of the material; “through-plane” (sometimes referred to as through-thickness) refers to the “c” direction and runs perpendicular to the plane.

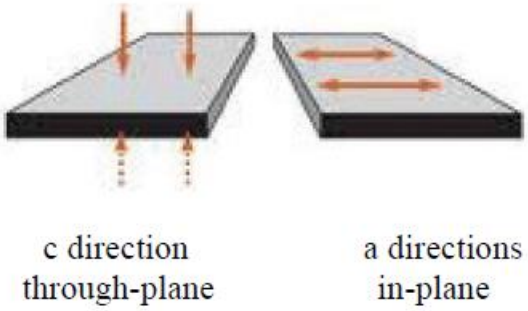

Illustration from Ex. 2005 ¶ 72 showing
“c-direction” through-plane and
“a-direction” in-plane thermal conductivity.

To be anisotropic with regard to thermal conductivity, a material’s through-plane and in-plane thermal conductivities *must* be different. *Id.* ¶ 73. If they were the same, the material would be thermally isotropic. *Id.*

As explained in the ’441 patent, the claimed heat dissipation and shielding system dissipates heat from an electronic component while simultaneously shielding a user or adjacent components from the effects of the heat generated by the component. Ex. 1001, col. 3, ll. 51–55. In other words, in a practical context, the “thermal solution”—an anisotropic CPEG

sheet—dissipates and shields heat to protect your hand from getting hot while holding your mobile phone and also to protect adjacent components within the phone.

In a preferred form, the anisotropic CPEG sheet employed as the thermal solution in the ’441 patent has an in-plane thermal conductivity substantially higher than its through-plane thermal conductivity. Ex. 1001, col. 3, ll. 61–63. Preferably, the anisotropic CPEG sheet has a thermal anisotropic ratio on the order of 10 or greater. *Id.* at col. 3, ll. 63–65. The thermal anisotropic ratio is the ratio of in-plane thermal conductivity to through-plane thermal conductivity. *Id.* at col. 3, ll. 66–67.

Anisotropic CPEG sheets were well-known in the prior art. Redacted PO Resp. 6 (citing Tzeng ’520 (Ex.1004)); *see also* Ex. 1001, col. 7, ll. 24–26 (citing U.S. Patent No. 3,404,061 (“Shane”), which is Ex. 1013 in this proceeding). Shane is incorporated by reference into the ’441 patent. Ex. 1001, col. 7, ll. 24–26.

B. Exemplary Claim

Clam 1 of the ’441 patent, the only independent claim, shown below, is exemplary of the claimed invention:

> 1. A thermal dissipation and shielding system for a cell phone, comprising:
>
> a cell phone comprising a first component which comprises a heat source and a second component to which the first component transmits heat;
>
> a thermal solution interposed between the first component and the second component,
>
> wherein the thermal solution comprises at least one sheet of compressed particles of exfoliated graphite which thermally shields the second component from heat generated by the first component.

> wherein the thermal solution comprises at least one sheet of compressed particles of exfoliated graphite which thermally shields the external surface of the electronic device from heat generated by the first component.

C. Scope and Content of the Prior Art

We summarize below the prior art, including the primary references asserted by Petitioner.

1. Shane (Exhibit 1013)

Shane issued on October 1, 1968, based on an application filed on April 15, 1963. Shane is prior art under 35 U.S.C. § 102(b). It also is part of the Admitted Prior Art cited by Petitioner.[2]

Shane establishes the basic characteristics of the CPEG material used in the claimed invention and known in the art. Shane also provides a "roadmap" of how to use CPEG. Dec. to Inst. 9; *see* Redacted PO Resp. 36.

Shane discloses a flexible sheet material that consists essentially of graphite, which possesses anisotropic, or highly directional, properties. Ex. 1013, col. 1, ll. 10–19; *see also* Redacted PO Resp. 38 ("Shane provides a general discussion of the anisotropic properties of CPEG sheet materials"). The graphite sheet in Shane has "excellent flexibility" and "good strength." Ex. 1013, col. 4, l. 46. The graphite sheet can be "pure graphite free of any binders," or, alternatively, additives, suitable organic and inorganic materials, can be incorporated therein so as to modify the nature or properties thereof." *Id.* at col. 13, ll. 56–59.

[2] As stated in our Decision to Institute, Petitioner defines "Admitted Prior Art" as "statements made in the '441 patent specification that identify the work and knowledge of others as prior art." Decision 5 n. 4 (citing Pet. 20).

Consistent with the very nature of anisotropic CPEG, and as explained in Shane, CPEG functions simultaneously as a *thermal conductor* (in the "*a* direction") and as a *thermal insulator* (in the "*c* direction").[3] *Id.* at col. 13, ll. 2-11 ("It possesses either low or high thermal conductivity dependent upon the orientation"); *see also id.* at col. 13, ll. 44-46 ("For example, the graphite material can be used as an *insulating* material and/or as a thermal *conductive* material") (emphases added).

Shane discloses "[t]he supple graphite sheet material can be provided with a uniform thickness . . . of . . . about 0.0001 inch (0.1 mil)" and can be used as an insulating barrier "in a very small space." Ex. 1013, col. 13, ll. 16-21, 31-36. Shane also discloses that the degree of anisotropy increases with increasing density; the greater the density, the greater the degree of anisotropy possessed by the flexible graphite sheet material. *Id.* at col. 4, ll. 65–69. The graphite sheet disclosed in Shane "possesses either low or high thermal *conductivity*, dependent upon the orientation." *Id.* at col. 13, ll. 10–11 (emphasis added). It also has "excellent thermal *insulating* properties from the cryogenic range up to 6700 °F." *Id.* at col. 13, ll. 18–19 (emphasis added). Shane concludes that a "very effective insulating barrier is thus available in a very small space." *Id.* at col. 13, ll. 19–21.

With disclosed uses as an insulating material and/or as a thermal conductive material (Ex. 1013, col. 13, ll. 2–11, 43–46), Shane thus discloses that the anisotropic properties of a CPEG sheet allow it to be used for both dissipating or conducting the heat away from a heat source, and for

[3] "In the anisotropic, flexible graphite sheet material, the *c* direction is the direction perpendicular to the surface plane, that is, the thickness direction and the *a* directions are the directions along the surface plane, that is, the width and length directions." Ex. 1013, col. 13, ll. 2-6.

protecting, insulating, or shielding elements from a heat source. Patent Owner's Declarant, Dr. Culham, states, "Shane also identifies that, in view of [CPEG's] anisotropic properties, [CPEG] can be employed as either a thermal conductor or a thermal insulator." Ex. 2005 ¶ 154. Dr. Culham opines, however, that Shane does not teach or suggest to a person skilled in the art that a CPEG sheet could be employed as an apparatus that simultaneously provides thermal dissipation and thermal shielding within an electronic device. *Id.* ¶ 155.

2. Norley (Ex. 1021)

Norley is a published article titled "The Development of a Natural Graphite Heat-Spreader." Norley states, "[t]he ongoing need for miniaturization and speed in the electronics industry has brought about a requirement for better performing thermal management systems." Ex. 1021, 1. Norley discloses using a naturally occurring graphite material "with high thermal conductivity to dissipate heat." *Id.* Norley also discloses "a high degree of thermal anisotropy" reduces temperature gradients and increases heat transfer (*id.*), thus recognizing both the heat dissipating and heat shielding properties of a thermally anisotropic material. Norley also discloses that graphite exhibits structural anisotropy and possesses many properties that are highly directional, e.g., thermal and electrical conductivity. *Id.* Additionally, Norley recognizes that natural graphites possess a very high degree of structural anisotropy, which makes them ideal starting materials for heat-spreader components. *Id.*

In one example, Norley discloses a graphite material with substantial thermal anisotropy. *Id.* at 2. The in-plane thermal conductivity is 230 W/m-K, compared to 4.5 W/m-K through the thickness of the laminate. *Id.* As

Norley points out, this yields a thermal anisotropy ratio of 52 and allows for directional control of heat flow for applications in which this is desired. *Id.*

Norley also discloses that the ratio of the in-plane to through-plane thermal conductivity can be varied through processing changes, allowing one "to produce a material in which the relative amounts of heat flowing in different directions can be controlled." *Id.* at 3–4.

The Norley Article concludes by noting that anisotropic natural graphite-based materials, with a ratio of in-plane to through-plane thermal conductivity typically ranging from 5 to 50, provide thermal engineers with the ability to control the anisotropy of these materials, the flexibility to channel heat in a preferred direction, and new design options that can reduce thermal failures in electronic devices. *Id.* at 4.

3. Tzeng '520 (Exhibit 1004)

U.S. Patent No. 6,482,520 ("Tzeng '520") discloses the use of CPEG sheets to dissipate heat from microprocessors, integrated circuits and other sophisticated electronic components. Ex. 1004, col. 1, ll. 20-27, col. 5, ll. 23-34. As Tzeng '520 notes, the excessive heat generated during operation of these components can not only harm their own performance, but can also degrade the performance and reliability of the overall system, and may cause system failure. *Id.* Tzeng '520 also recognizes that "both performance reliability and life expectancy of electronic equipment are inversely related to the component temperature of the equipment." *Id.* at col. 1, ll. 34-37. Thus, Tzeng '520 recognizes that the heat generating microprocessor or integrated circuit, to which the disclosure is directed specifically, is used in a system with other components.

Tzeng '520 emphasizes the heat *dissipating* properties of CPEG but

also refers to CPEG's inherent heat *shielding* properties. Tzeng '520 discloses:

> the thermal conductivity of thermal interface 20 is significantly greater in the "a" direction (the direction parallel to the crystalline planes of the graphite, or along the surface of the flexible graphite sheet) than in the "c" direction (the direction perpendicular to the crystalline planes of the graphite, or transverse to the flexible graphite sheet), often by a factor of 20 times or greater. Thus, when thermal interface 20 is arrayed or mounted on external surface 100a of electronic component 100 such that one of its planar surfaces 20a sits against external surface 100a, as shown in FIGS. 1 and 2, heat generated by or from electronic component 100 spreads about the planar surfaces 20a and 20b of thermal interface 20, not just directly through thermal interface 20 in the "c" direction.

Ex. 1004, col. 7, ll. 47-60. Thus, the diminished thermal conductivity in the "c" direction provides, in effect, thermal shielding or thermal protection in the "c" direction.

According to Patent Owner, "Tzeng '520 does an excellent job of describing compressed particles of exfoliated natural graphite ('CPEG') and how it is made." Redacted PO Resp. 6. "Tzeng '520 explains that the orientation in certain graphites results in an anisotropic structure and also explains how the spacing between the carbon layers can be opened and expanded in the 'c' direction and that the expanded graphite structure is referred to as exfoliated or intumesced graphite." *Id*. at 6–7.

4. Mercuri (Ex. 1023)

European Patent Specification EP 0988261 B1 ("Mercuri") discloses a graphite composite material used to protect against thermal damage. Ex. 1023, col. 1, ll. 5–14. Mercuri discloses how highly anisotropic thermal

conductivity characteristics of roll-pressed flexible graphite are employed in addressing high temperature *shielding* applications. Ex. 1023, col. 4, ll. 51-54 (emphasis added).

D. Level of Ordinary Skill

Petitioner relies on the Declaration of William Bagot (Ex. 1012) to assert that a person of ordinary skill in the art would have had a Bachelor of Science degree in materials science (or similar engineering discipline, including thermal engineering), and five or more years of experience in the field of the management of heat in electronic devices using flexible graphite sheets. Pet. 19 (citing Ex. 1012 ¶ 18).[4]

Patent Owner relies on the Declaration of Richard Culham, Ph.D. (Ex. 2005) to assert a level of ordinary skill in the art that differs slightly from that asserted by Petitioner.[5] Redacted PO Resp. 16 (citing Ex. 2005 ¶¶ 122–125). In Dr. Culham's opinion, a person of ordinary skill in the art in the field of the '520 patent would be one with at least a Bachelor's degree in an engineering discipline (such as mechanical engineering or electrical

[4] Mr. Bagot has significant work experience in the field of materials science, including graphite materials, and in systems and devices for managing heat in electronic devices. Ex. 1012 ¶¶ 7–16. We are satisfied that based on his knowledge, skill, experience, training, and education, he may testify on this issue and on other matters in his Declaration in the form of an opinion. *See* Fed. R. Evid. 702.

[5] Dr. Culham has nearly 30 years of expertise in modeling, characterization, and development of components and materials related to thermal management of micro and nanoscale devices. Ex. 2005 ¶ 7–17. He is a Full Professor in the Department of Mechanical and Mechatronics Engineering at the University of Waterloo in Waterloo, Ontario, Canada. *Id.* ¶ 8. We are satisfied that based on his knowledge, skill, experience, training, and education, he may testify on this issue and on other matters in his Declaration in the form of an opinion. *See* Fed. R. Evid. 702.

engineering) or an applied physics discipline, and at least three to five years of experience with thermal management. Ex. 2005 ¶ 123. Dr. Culham states that the patentability of the challenged claims does not depend on whether Petitioner's or Patent Owner's asserted definition is used. *Id.* ¶ 125. We agree with Dr. Culham that the differences with the position asserted by Petitioner are slight, and, in our view, insignificant in resolving the issue of the patentability of the challenged claims.

II. ANALYSIS

A. Claim Construction

In an *inter partes* review, claim terms in an unexpired patent are interpreted according to their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b); *In re Cuozzo Speed Technologies LLC*, No. 2014-1301, 2015 WL 448667, at *5–*8 (Fed. Cir. Feb. 4, 2015) ("Congress implicitly adopted the broadest reasonable interpretation standard in enacting the AIA," and "the standard was properly adopted by PTO regulation."); Office Patent Trial Practice Guide, 77 Fed. Reg. 48,756, 48,766 (Aug. 14, 2012). Claim terms also are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). If an inventor acts as his or her own lexicographer, the definition must be set forth in the specification with reasonable clarity, deliberateness, and precision. *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1249 (Fed. Cir. 1998). If a feature is not necessary to give meaning to what the inventor means by a claim term, it would be "extraneous" and should not be read into the claim. *Id.*; *E.I. du Pont de Nemours & Co. v. Phillips Petroleum Co.*,

849 F.2d 1430, 1433 (Fed. Cir. 1988); *see also Specialty Composites v. Cabot Corp.*, 845 F.2d 981, 987 (Fed. Cir. 1988) ("Where a specification does not *require* a limitation, that limitation should not be read from the specification into the claims.").

Petitioner does not assert any specific claim construction. Pet. 18–19. Petitioner recommends that we "should not construe the terms, as doing so would be offering an advisory opinion regarding the scope of those terms." Reply 8.

Patent Owner submits that five phrases from the challenged claims of the '441 Patent should be construed: (1) "thermal dissipation"; (2) "thermal shielding"; (3) "thermal dissipation and shielding system"; (4) "heat source"; and (5) "sheet of compressed particles of exfoliated graphite." Redacted PO Resp. 16–19.

We construe the proposed terms to avoid any ambiguity in their meaning, and to establish both what the claims mean and what they do not mean.

1. Thermal Dissipation

The phrase "thermal dissipation" is in the preamble of independent claim 1 ("A thermal dissipation and shielding system"). We note, to avoid any confusion, that the claims also use the phrase "heat dissipation." *See, e.g.*, Ex. 1001, claim 2 ("The system of claim 1, wherein the cell phone further comprises a heat dissipation device").

Patent Owner proposes that the broadest reasonable interpretation of the phrase "thermal dissipation" as used in the '441 Patent is "the removal of heat from an electronic component by distributing the component's heat over an increased area and/or volume and ultimately removing the heat by

convection into the surrounding environment, such as the air." Redacted PO Resp. 17 (citing Ex. 2005 ¶¶ 127-131; Ex. 1001, col. 3, ll. 61-62, col. 14, ll. 35-39, col. 15, ll. 6-8).

Dr. Culham states that the '441 patent "does not specifically define this phrase." Ex. 2005 ¶ 127.

The Specification states that the "thermal solution," that is the CPEG sheet, "spreads the heat from [the] heat source." Ex. 1001, col. 14, ll. 25–29. Dr. Culham states that this is a description of "how heat dissipation apparatuses operate." Ex. 2005 ¶ 129.

Patent Owner's proposed interpretation brings in extraneous factors into the proposed definition. Considered in its broadest sense, the phrase "thermal dissipation" is not limited to electronic components, distributing heat over an increased area and/or volume, or removing heat by convection into the surrounding environment, as proposed by Patent Owner.

Accordingly, the broadest reasonable construction in light of the Specification of the '441 patent of the phrase "thermal dissipation" is spreading heat from a heat source.

2. Thermal Shielding

The phrase "thermal shielding" also is in the preamble of independent claim 1 ("A thermal dissipation and shielding system"). Claim 1 also states that the CPEG sheet "thermally shields" the second component from heat.

Although neither party proposed any specific claim construction, in our Decision to Institute, we adopted a construction for the phrase "thermal shields" or "thermal shielding." Dec. 6–7.

Patent Owner "submits that the definition in our Decision to Institute[6] is somewhat incomplete as it fails to take into account the description of thermal shielding from the specification and the accepted definition of a thermal shield within the art." Redacted PO Resp. 17–18. According to Patent Owner, the disclosure of the '441 patent "demonstrates that thermal shielding is protection of a portion of the device *other than the heat source itself* from heat generated by a heat source. *Id.* at 18 (citing Ex. 2005 ¶¶ 135–37). Patent Owner's proposed definition incorporates too much of the Specification to be the broadest reasonable interpretation of this phrase as used in the claims.

The claims refer to a "shielding system" and recite a CPEG sheet that "thermally shields" devices or components from a heat source. *See, e.g.,* Ex. 1001, claim 1 ("wherein the thermal solution comprises at least one sheet of compressed particles of exfoliated graphite which *thermally shields* the external surface of the electronic device *from heat generated by the first component*") (emphases added). Thus, the claim language recites that the CPEG sheet shields a portion of the device from the heat source. Patent Owner proposes that we add into the claim the additional limitation that the thermal shielding does not shield the heat source itself.

Neither party directs us to any unique definition in the Specification of the word "shield" or its grammatical variants, nor do the parties direct us to any statements in the Specification or during prosecution where the patentee disavowed the full scope of the claim terms "shields" or

[6] "the broadest reasonable construction in light of the Specification of the claim term 'thermally shields' or 'thermal shielding' is any structure that protects against heat." Dec. to Inst. 8.

"shielding." We are not directed to any persuasive disclosure in the Specification that supports Patent Owner's proposed construction.

If the specification does not assign or suggest a particular definition to a claim term, it is appropriate to consult a dictionary definition of the word for guidance in determining the ordinary and customary meaning of the claim term as viewed by a person of ordinary skill in the art. *Comaper Corp. v. Antec, Inc*., 596 F.3d 1343, 1348 (Fed. Cir. 2010); *see also Starhome GmbH v. AT&T Mobility LLC*, 743 F.3d 849, 856 (Fed. Cir. 2014) ("We have made clear that dictionaries and treatises can often be useful in claim construction").

A common dictionary definition of the word "shield" is "to cover and protect."[7]

Accordingly, the broadest reasonable construction in light of the Specification of the claim term "thermal shields" or "thermal shielding," or its grammatical variants, is protection against heat, a minor variation of the definition in our Decision to Institution.

3. Thermal Dissipation and Shielding System

The phrase "thermal dissipation and shielding system" appears only in the preamble of independent claim 1.

Patent Owner proposes that the "broadest reasonable interpretation of a 'thermal dissipation and shielding system' is a system that simultaneously accomplishes thermal dissipation from a heat source and thermal shielding of an adjacent structure, such as a second component or external surface of the device, from the heat generated by that heat source." Redacted PO Resp.

[7] "Shield," Merriam-Webster.com, at http://www.merriam-webster.com/dictionary/shield (accessed Feb. 25, 2014).

18. Patent Owner incorporates more than is necessary in its proposed definition. For example, we have not been directed to anything in the Specification that requires a construction limited to shielding adjacent structures.

Accordingly, the broadest reasonable construction in light of the Specification of the '441 patent of the phrase "thermal dissipation and shielding system" is a system that dissipates and shields heat, consistent with our constructions of "thermal dissipation" and "thermal shielding" discussed above.

4. Heat Source

Patent Owner proposes that the broadest reasonable interpretation of the phrase "heat source" is "any component within an electronic device that generates heat." Redacted PO Resp. 18.

Patent Owner cites portions of the claims to support the proposed construction. *Id.* Patent Owner also cites Dr. Culham's Declaration. *Id.* Dr. Culham refers to examples of a heat source mentioned in the Specification. Ex. 2005 ¶ 142. Because the examples mentioned include components that may be within an electronic device, such as hard drives and microprocessors, Dr. Culham maintains that the definition of "heat source" should be limited to being within an electronic device. We are not persuaded that there is any basis for incorporating unnecessary limitations from the Specification into the construction of the phrase "heat source."

When describing the invention in the Abstract, for example, the Specification states that a thermal solution for a portable electronic device may be "positioned between a heat source and another component of the electronic device," where the thermal solution facilitates heat dissipation

from the heat source while shielding the second component from the heat generated by the heat source. Ex. 1001, Abstract. This description does not require the heat source to be *within* the electronic device.

Accordingly, the broadest reasonable construction in light of the Specification of the '441 patent of the phrase "heat source" simply is a source of heat.[8]

5. Sheet of Compressed Particles of Exfoliated Graphite

Patent Owner proposes that the broadest reasonable interpretation of the phrase "sheet of compressed particles of exfoliated graphite" is a graphite sheet formed of compressed particles of exfoliated *natural* graphite." Redacted PO Resp. 19 (emphasis added). Essentially, the Patent Owner wants to add the word "natural" into the claims. Patent Owner cites to the Specification and to claim 1 for support (*id.* (citing Ex. 1001, col. 16, ll. 43–44; col. 17, l. 18–[19])), but the cited passages do *not* contain any reference to the word "natural" when referring to the claimed graphite material. Patent Owner also cites for support the Declaration of Dr. Culham. *Id.* Dr. Culham states that the "specification provides a detailed description of the type of material" used for the CPEG sheet, generally citing eight columns of text from the Specification. Ex. 2005 ¶ 143.

> Concerning the type of graphite used in the disclosed system, the Specification states that "[g]raphite starting materials suitable for use in the present invention include highly graphitic carbonaceous materials capable

[8] "These are ordinary, simple English words whose meaning is clear and unquestionable. There is no indication that their use in this particular conjunction changes their meaning. They mean exactly what they say." *Chef America, Inc. v. Lamb-Weston, Inc.*, 358 F.3d 1371, 1373 (Fed. Cir. 2004).

of intercalating organic and inorganic acids as well as halogens and then expanding when exposed to heat." Ex. 1001, col. 6, ll. 50–53. The Specification also states, "*[e]xamples* of highly graphitic carbonaceous materials include *natural* graphites from various sources, *as well as other carbonaceous materials* such as graphite prepared by chemical vapor deposition, high temperature pyrolysis of polymers, or crystallization from molten metal solutions and the like. *Natural graphite is most preferred.*" *Id.* at col. 7, ll. 4–10 (emphases added). Thus, through its proposed construction, Patent Owner tries to include a preferred element from the Specification into the claims. "Where a specification does not *require* a limitation, that limitation should not be read from the specification into the claims." *Specialty Composites*, 845 F.2d at 987.

Accordingly, we determine that the broadest reasonable interpretation of the phrase "sheet of compressed particles of exfoliated graphite" is *not* limited to natural graphite.

B. Asserted Grounds of Unpatentability

The Supreme Court has made clear that we apply "an expansive and flexible approach" to the question of obviousness. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 415 (2007). Whether a patent claiming the combination of prior art elements would have been obvious is determined by whether the improvement is more than the predictable use of prior art elements according to their established functions. *Id.* at 417. To reach this conclusion, however, requires more than a mere showing that the prior art includes separate references covering each separate limitation in a claim under examination. *Unigene Labs., Inc. v. Apotex, Inc.*, 655 F.3d 1352, 1360 (Fed. Cir. 2011). Rather, obviousness requires the additional showing

that a person of ordinary skill at the time of the invention would have selected and combined those prior art elements in the normal course of research and development to yield the claimed invention. *Id.* As the Supreme Court recognized, in many cases a person of ordinary skill "will be able to fit the teachings of multiple patents together like pieces of a puzzle," recognizing that a person of ordinary skill "is also a person of ordinary creativity, not an automaton." *Id.* at 420–21. Against this general background, we consider the references, other evidence, and arguments of the parties.

1. Obviousness Based on Norley, Tzeng '520, Mercuri, and APA

Petitioner asserts that claims 1, 4, 5, 10–12, 14, and 15 are unpatentable under 35 U.S.C. § 103(a) based on Norley, Tzeng '520, and Mercuri, and "Admitted Prior Art" ("APA"). Pet. 20, 22. Petitioner asserts that the Norley Article "describes the various properties, options, and potential heat management applications (including in mobile electronic appliances) for an Exfoliated Graphite sheet."[9] *Id.* at 22. Petitioner also asserts that Tzeng '520 discloses a CPEG sheet in contact with a heat source and positioned "between a heat source and a second component." *Id.* at 27 (citing Ex. 1004, col. 13, ll. 16-18 ("A thermal interface consisting of a 1"x1" sheet of anisotropic flexible graphite sheet was interposed between the copper heat sink and the heat source.")). Petitioner asserts that Mercuri "discloses the use of Exfoliated Graphite for use in thermal shielding applications." *Id.* at 23.

[9] Petitioner uses the phrase "Exfoliated Graphite" to mean "compressed particles of exfoliated graphite." Pet. 1. Thus, the phrase "Exfoliated Graphite" is synonymous with the acronym CPEG, which is used in this Final Decision to designate compressed particles of exfoliated graphite.

Petitioner's rationale for combining the references is that it would have been obvious to a person having ordinary skill in the art, as a "simple matter of design choice," to apply known heat dissipation and shielding techniques to the electronic components in a cell phone. *Id.* at 28.

Patent Owner takes a different view of the cited references. Patent Owner asserts that a "careful review of those references reveals that they all fail to provide any teaching, suggestion, or other motivation for employing a CPEG sheet as a heat shield in an electronic device." Redacted PO Resp. 21.

Regarding the APA, Patent Owner asserts that the APA "merely consists of statements in the '441 Patent's Background section that relate to the generation of heat by certain components within electronic devices and the need to utilize thermal management to dissipate that heat." *Id.* at 22. According to Patent Owner, "[n]owhere in the cited APA is the concept of thermal shielding mentioned or even remotely suggested." *Id.* Regarding Shane, Patent Owner asserts that "Shane does not disclose that a CPEG sheet can be used simultaneously as both a heat dissipater and a heat shield – nowhere in Shane is the idea of simultaneous spreading and shielding of a heat source mentioned or even suggested." *Id.* at 37.

In our Decision to Institute, we stated that Shane also was part of the prior art, is referenced in the '441 patent, and is considered part of the prior art admitted and acknowledged in the '441 patent. Dec. 9.

Based on our discussion of Shane above, we do not agree that "[n]owhere in the cited APA is the *concept* of thermal shielding mentioned or even remotely suggested," as asserted by Patent Owner. Although Shane may not use the word "shield," Shane discloses that a CPEG sheet protects

against heat, which is how we construe the term "thermally shields" and its variants. Shane discloses that CPEG sheets "can be used as an *insulating* material *and*/or as a thermal *conductive* material." Ex. 1013, col. 13, ll. 44-46 (emphases added). We interpret the statement Shane's disclosure to mean that CPEG sheets can both insulate, or shield from heat, *and* conduct, or dissipate heat, simultaneously. Indeed, the inherent nature of anisotropic CPEG is that it functions, simultaneously, to both shield and dissipate. As Dr. Culham stated, "[t]o be anisotropic with regard to thermal conductivity, a material's through-plane and in-plane thermal conductivities *must* be different." Ex. 2005 ¶ 73. Thus, on a relative basis, one plane is more conductive than the other, meaning that the less conductive plane blocks or shields heat while the more conductive plane dissipates or spreads heat. Within the broadest reasonable interpretation of the challenged claims, this is all that is required, for example, to meet the "dissipation" and "shielding" limitations in claim 1. This interpretation of "shielding" is fully consistent with the disclosure in the '441 patent.

The '441 patent discloses that, "because of the relatively low through-plane thermal conductivity of thermal solution 10, heat does not flow through thermal solution 10 effectively, preventing overheating of the environment shielded by thermal solution 10. This would not be possible if a more isotropic material such as copper or aluminum were used." Ex. 1001, col. 15, ll. 31–37. Thus, low through-plane thermal conductivity creates the shielding or protection required by the claims.

Patent Owner asserts that Norley "is plainly directed toward thermal dissipation, *not thermal shielding*." Redacted PO Resp.24. According to Patent Owner, "[n]owhere in the Norley Article is the concept of employing

a CPEG sheet as a heat shield even mentioned, nor are the insulating properties of a CPEG sheet discussed."[10] *Id.* Patent Owner asserts that Norley discloses a "heat spreader." *Id.* Patent Owner argues that "[h]eat spreaders and heat shields are completely different types of thermal management solutions." *Id.* at 25. Patent Owner states that heat spreaders and heat shields "are generally mutually exclusive in their desired properties (high thermal conductivity for spreaders; high insulating ability for shields)." *Id.* Based on the broadest reasonable interpretation of "thermal shielding," as already discussed, we disagree and determine the evidence supports Petitioner's view of Norley's teachings.

Regarding Tzeng '520, Patent Owner asserts that Tzeng '520 "is focused solely on the use of CPEG sheet in heat dissipation devices. Redacted PO Resp. 36. According to Patent Owner, Tzeng '520 "does not teach, suggest, or otherwise motivate a person of skill in the art to utilize CPEG sheet as a thermal shield, much less to utilize the material to produce a device which acts simultaneously as a heat shield and heat spreader." *Id.*

Regarding Mercuri, Patent Owner asserts that "Mercuri generally describes composite heat shielding devices, [but] it only describes employing flexible graphite materials as heat dissipaters, not as thermal shields." Redacted PO Resp. 31.

Petitioner asserts that Patent Owner's position overlooks the fact that "because CPEG is highly anisotropic, it acts as *both* a heat dissipater *and* a heat shield." Reply 1. Petitioner also asserts that because Norley discloses a

[10] There can be no reasonable dispute that Shane discloses the *insulating* properties of CPEG. *See* Ex. 1013, col. 13, ll. 44–46 (CPEG "can be used as an *insulating* material and/or as a thermal conductive material") (emphasis added).

CPEG material with a thermal anisotropy ratio of 52, it teaches that CPEG conducts or dissipates heat in the in-plane direction and shields heat in the through-plane direction. *Id.* at 1–2. In a preferred embodiment, the '441 patent discloses a thermal anisotropic ratio of "no less than 10" to achieve the claimed simultaneous dissipation and shielding. Ex. 1001, col. 13, ll. 33–35. Petitioner also states correctly that "the challenged claims of the '441 patent do not require a specific level of shielding, only that the CPEG thermally shields." *Id.* at 2.

Petitioner also asserts that the same CPEG material disclosed in Norley and Tzeng'520 is the CPEG material disclosed in the '441 patent and recited in the challenged claims. *Id.* at 3–4. Petitioner concludes that "if CPEG in the later '441 patent shields, then CPEG in the earlier [Tzeng]'520 patent and Norley also shields." *Id.* at 4. Based on the evidence of record, we agree with Petitioner. In summary, Patent Owner argues that the "cited references only employ CPEG sheet as a heat dissipater, relying on its high conductivity in the *a*-plane; none of the references utilize the CPEG sheet as a thermal shield material by relying upon its insulating properties." Redacted PO Resp. 45. Here, Patent Owner recognizes that it is the in-plane, or *a*-plane, high conductivity that dissipates heat; whereas it is the *c*-plane, or through-plane, low conductivity that shields heat. This is exactly what Shane, Norley, and Tzeng '520 teach. Norley, with an anisotropic conductivity ratio of 52 clearly teaches and suggests both dissipation in the a-plane and shielding in the c-plane.

a. Independent Claim 1

Independent claim 1 requires a cell phone having a heat source and a "second component" to which the heat source transmits heat. Claim 1 also

requires a CPEG sheet that "thermally shields" the second component from heat generated by the heat source. As we have construed the phrase "thermally shields," it means any structure that protects against heat. Thus, independent claim 1 requires a CPEG sheet that protects the second component from heat generated by the heat source.

Except for the phrase "thermal dissipation" in the preamble, independent claim 1does not refer to or otherwise recite any structure, function, or system relating to dissipating heat. Claim 1 requires only that the CPEG sheet "thermally shields" or protects against heat. The claim does not quantify the type or amount of protection provided by the CPEG sheet.

The issue presented by the parties' differing interpretation of the references, in the context of claim 1, is whether anisotropic CPEG functions to thermally shield. The preponderance of the evidence establishes that it does.

As discussed above in our discussion of the references, Shane discloses that the anisotropic properties of a CPEG sheet allow it to be used for simultaneously dissipating or conducting the heat away from a heat source and for protecting, insulating, or shielding elements from a heat source.

Norley recognizes that anisotropic CPEG provides thermal engineers the flexibility to channel heat in a preferred direction, and offers new design options that can reduce thermal failures, that is protect components from heat, in electronic devices. Ex. 1021, 4.

As discussed above, Tzeng '520 discloses the use of CPEG sheets to dissipate heat from microprocessors, integrated circuits and other sophisticated electronic components. Ex. 1004, col. 1, ll. 20-27, col. 5, ll.

23-34.

Patent Owner admits that "a CPEG sheet is employed in the composite *shielding* devices of Mercuri." Redacted PO Resp. 29 (emphasis added). Patent Owner asserts, however, that Mercuri teaches that the CPEG sheet material is only used as a heat dissipation device. *Id.* We disagree and conclude that the evidence supports Petitioner's contention that Mercuri teaches the use of CPEG to shield, i.e., protect, from heat.

Petitioner asserts that a person having ordinary skill in the art would have combined the cited references, as a matter of mere design choice, and used Exfoliated Graphite between two components in an electronic device, such as a cell phone. Pet. 28 (citing Ex. 1012 ¶ 41).

Regarding design choice of materials, Dr. Culham, Patent Owner's Declarant, opines that "selection of a thermally-anisotropic material for a particular thermal application is a delicate and difficult task that depends strongly on the requirements of the application. It requires examining many properties of a given material and balancing these multiple, interrelated, and potentially competing properties and interests." Ex. 2005 ¶ 79. Based on the evidence, however, we conclude that selecting the CPEG material for the task at hand—shielding a cell phone component from heat—would have required merelyroutine experimentation in balancing known variables, as suggested in Shane's roadmap.

Petitioner also asserts that person having ordinary skill in the art would have known that placing Exfoliated Graphite between a heat source in a cell phone and a second component of the cell phone, would have the advantageous effect of "thermally shield[ing] the second component from heat generated by the first component." Pet. 30 (citing Ex. 1012 ¶¶ 36-37).

Patent Owner asserts that claims 1, 4, 5, 10-12, 14, and 15 would not have been obvious to a person of ordinary skill in the art "because none of *the cited references* teaches, suggests, or otherwise motivates a person skilled in the art to employ a CPEG sheet as a thermal shield material in a cell phone to shield a second component from heat generated by a heat source." Redacted PO Resp. 40 (citing Ex. 2005 ¶ 222) (emphasis added).

As set out above in our discussion of *KSR*, we take "an expansive and flexible approach" in addressing the issue of obviousness. "The obviousness analysis cannot be confined by a formalistic conception of the words teaching, suggestion, and motivation, or by overemphasis on the importance of published articles and the explicit content of issued patents." *KSR*, 550 U.S. at 419. In *Dystar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick*, 464 F.3d 1356, 1368 (Fed. Cir. 2006), the Federal Circuit recognized the broad scope of a motivation to combine references:

> Indeed, we have repeatedly held that an implicit motivation to combine exists not only when a suggestion may be gleaned from the prior art as a whole, but when the 'improvement' is technology-independent and the combination of references results in a product or process that is more desirable, for example because it is stronger, cheaper, cleaner, faster, lighter, smaller, more durable, or more efficient. Because the desire to enhance commercial opportunities by improving a product or process is universal—and even common-sensical—we have held that there exists in these situations a motivation to combine prior art references even absent any hint of suggestion in the references themselves.

The obviousness analysis "need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of

ordinary skill in the art would employ." *KSR*, 550 U.S. at 418. "Common sense teaches, however, that familiar items may have obvious uses beyond their primary purposes, and in many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle." *Id.* at 420. Mercuri explicitly discloses using a CPEG sheet for thermal shielding. Tzeng '520 discloses use of CPEG for heat shielding and heat dissipating in electronic systems, and the Norley Article specifically discloses use of CPEG in mobile electronic appliances, which would encompass a cell phone. We are not persuaded that a person of ordinary skill in the relevant technology would ignore these prior art disclosures because the references may not use the same terminology as the claimed invention, or may use this technology somewhat differently than the claimed invention.

Based on the preponderance of evidence, we are persuaded that there is a sufficient rationale to support the proposed combination of references, and that Petitioner has shown sufficiently that the combination teaches or suggests each limitation of claim 1.

b. Claims 4, 5, 10-12, 14, and 15

Dependent claims 4 and 5 recite specific thermal conductivity values. The in-plane thermal conductivity of at least about 140 W/m-K called for in claim 4 is disclosed in the Norley Article and Tzeng '520, as asserted by Petitioner. Pet. 30-31; Ex. 1021, 3; Ex. 1004, col. 4, ll. 25-38. Likewise, both the Norley Article and Tzeng '520 disclose a through-plane thermal conductivity of no greater than about 12 W/m-K, as required by claim 5. Pet. 30-31; Ex. 1021, 3; Ex. 1004, col. 4, ll. 25-38.

Dependent claims 10-12, 14, and 15 recite specific types of electronic

components, such as a power amplifier or a key pad. Petitioner asserts that each specific type of electronic component would have been obvious to a person or ordinary skill and creativity. Pet. 31-33 (citing Ex. 1012 ¶ 44–48). The Specification does not identify any heat dissipating or shielding problems that are unique to the components claimed.

Patent Owner has not addressed specifically the assertions against claims 4, 5, 10-12, 14, and 15.

Based on the preponderance of the evidence, we are persuaded that claims 4, 5, 10-12, 14, and 15 would have been obvious based on the cited references.

2. Obviousness Based on Norley, Tzeng '520, Mercuri, and Richey

Petitioner asserts that claims 2, 3, 8, and 9 would have been obvious based on Norley, Tzeng '520, and Mercuri, as applied and discussed above, and also combined with Richey, U.S. Patent No. 6,131,651 (Ex. 1018).

Claim 2 depends from claim 1 and requires a "a heat dissipation device positioned in a location not directly adjacent to the first component and further wherein one of the major surfaces of the thermal solution is in operative contact with the heat dissipation device." This structural arrangement is shown in Figure 1. Claim 3 depends from claim 2 and states that the heat dissipation device comprises a heat sink, a heat pipe, a heat plate, or any combination thereof.

Claim 8 depends from claim 1 and requires a "thermal transfer material" positioned between the CPEG sheet and the first component. Claim 9 depends from claim 8 and requires the thermal transfer material to be "a metal or a thermal interface."

The Specification states that in an embodiment of the invention, the CPEG sheet can have a protective coating, such as a plastic. Ex. 1001, col. 5, ll. 56-63. The Specification also states that a "thermal transfer material, like a metal or a thermal interface, can also be positioned between the thermal solution and the first component." *Id.* Thermal transfer material 130, shown in Figure 3, is intended "to improve handleability and mechanical robustness of thermal solution 10" and also "to facilitate thermal transfer between heat source 100 and thermal solution 10." *Id.* at col. 16, ll. 32-40. One such thermal transfer material is a metal, such as copper or aluminum. *Id.*

Richey discloses a thin flexible heat transfer device for transferring heat from a heat source to a heat sink, which may be located a substantial distance apart from each other. Ex. 1018, Abstract. The heat transfer device includes a thin sheet of a non-structural, high thermal conductivity core material consisting of pyrolytic graphite or highly ordered pyrolytic graphite. *Id.* Figure 1 of Richey is shown below.

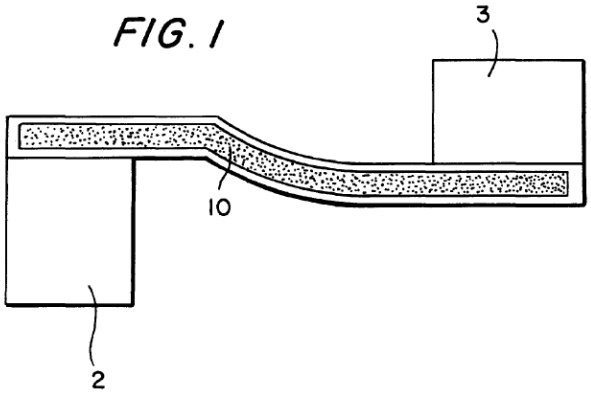

Figure 1 of Exhibit 1018 is a cross-sectional view of a heat transfer device (10) shown connected between a heat source (2) and a heat sink (3).

As shown in Figure 1 above, Richey discloses heat transfer device 10 physically connected between heat source 2 and heat sink 3, which can be separated by a substantial distance and in areas not easily accessible. Ex. 1018, col. 3, ll. 49-52. Heat transfer device 10 is easily bent and shaped to be connected by any conventional means for affixing heat transfer device 10 to respective heat source 2 and heat sink 3, such as using a clamp or bolt, or by welding or soldering. *Id.* at col. 3, ll. 52-56.

Petitioner asserts it would have been obvious to a person having ordinary skill in the art, based on Richey's teaching to remove heat in space constrained areas, to use the CPEG sheet taught by the Norley Article and Tzeng '520 to transfer heat from a heat source to a heat sink placed at a convenient and useful location. Pet. 50-51.

Richey also discloses transfer device 10 that consists of a non-structural high thermal conductivity core material, such as graphite, in the form of strip 12. Ex. 1018, col. 2, ll. 8-10. Strip 12 is sealed or bonded between two opposing face sheets 13 and 14, preferably in the form of foil strips. *Id.* at col. 2, ll. 10-12. Face or foil strips 13 and 14 are composed from sheet metal of preferably high conductivity, such as aluminum or copper. *Id.* at col. 2, ll. 40-43.

Petitioner asserts it would have been obvious to a person having skill in the art to employ Richey's foil strips 13, 14 between a CPEG sheet and the heat source because those strips increase the ease of handling of the heat transfer device 10 independent of the core material composition 12. Pet. 52.

Claim 8 specifies a "thermal transfer material" between the CPEG sheet and the heat source. As discussed above, Richey discloses a transfer device 10 with a strip of high thermal conductivity core material, such as

graphite, that is sealed or bonded between two foil strips 13 and 14 composed from sheet metal of preferably high conductivity, such as aluminum or copper. *Id.* at col. 2, ll. 8-13, 40-43. Since the foil strips have high thermal conductivity, we conclude they constitute a thermal transfer material located between a graphite sheet and heat source.

Petitioner asserts it would have been obvious to a person having skill in the art to employ Richey's foil strips 13 and 14 between the CPEG sheet and the heat source disclosed in the Norley Article and Tzeng '520, because the strips would provide a surface on which to attach the CPEG sheet, rather than attaching the sheet directly to a hard drive (which may later need to be replaced). Pet. 42 (citing Ex. 1012 ¶¶ 62-63). Petitioner points out that Richey discloses using the foil strips to increase the ease of handling of the heat transfer device 10 independent of the core material composition 12. *Id*.

Claim 9, depending from claim 8, recite that the thermal transfer material comprises a metal or a thermal interface. As explained above, Richey discloses using aluminum or copper as a thermal transfer material.

Patent Owner asserts that "Richey fails to provide any suggestion or other disclosure that would correct the cited deficiencies of the Norley Article, Tzeng '520, Mercuri, and the APA." Redacted PO Resp. 47. As discussed above, however, we are persuaded the combination of Norley, Tzeng '520, and Mercuri does not have the "deficiencies" alleged by Patent Owner. Patent Owner also asserts that Richey uses pyrolytic graphite (or highly ordered pyrolytic graphite), which is not the same material as a CPEG sheet. *Id*. Petitioner is relying, however on the primary references for the disclosure of CPEG, and relying on Richey for the disclosure of a heat sink structure.

We are persuaded that, on the record before us, the references suggest that claims 2, 3, 8, and 9 would have been obvious.

3. Obviousness Based on Norley, Tzeng '520, Mercuri, APA, and Tzeng '076

Dependent claim 6 requires a protective coating on the CPEG sheet. The Specification of the '441 patent states that the "thermal solution can have a protective coating, such as plastic." Ex. 1001, col. 5, ll. 56-63. The protective coating "can comprise any suitable material sufficient to prevent the flaking of the graphite material and/or to electrically isolate the graphite, such as a thermoplastic material like polyethylene, a polyester or a polyimide. *Id.* at col. 16, ll. 4-8.

Tzeng '076 discloses verbatim the same protective coating for the same purpose as is disclosed in the '441 patent. *Compare* Ex. 1020 ¶ 0044 *with* Ex. 1001, col. 16, ll. 4-8.

Petitioner asserts that since Tzeng '076 discloses the same protective coating disclosed and called for in claim 6, and because the cited references all deal with heat management in electronic devices, it would have been obvious to a person of ordinary skill to use the protective coating in Tzeng '076 on the structure suggested by the other references. Pet. 53-54.

Patent Owner asserts that "nowhere is the concept of using a CPEG sheet as a shield even so much as mentioned or suggested" in Tzeng '076. Redacted PO Resp. 48. Patent Owner also asserts that Tzeng '076 does not "highlight" the insulating properties of CPEG sheet. *Id*. at 48–49. According to Patent Owner, Tzeng '076, like the other cited references, completely focuses on the heat dissipation properties of CPEG sheet. *Id.* at 48.

Petitioner is relying, however, on the primary references for the disclosure of CPEG, and relying on Tzeng ’076 for the disclosure of a coating.

Based on the preponderance of the evidence, we are persuaded that claim 6 would have been obvious based on the cited references.

4. Obviousness Based on Norley, Tzeng ’520, Mercuri, Tzeng ’076, and Kapton Website

Claim 7 depends from claim 6 and further requires that the protective coating have a thermal conductivity less than the through-plane thermal conductivity of the CPEG sheet. Claim 7 does not state a numeric value of the thermal conductivity of the CPEG sheet.

The ’441 patent states that a plastic protective coating preferably has a thermal conductivity less than the through-plane thermal conductivity of the at least one sheet of flexible graphite. Ex. 1001, col. 5, ll. 56-60. The ’441 patent Specification identifies “Kapton polyimide materials” as a suitable coating. *Id.* at col. 16, l. 25.

Petitioner asserts that the protective coatings described in Tzeng ’076 inherently have the limitation of claim 7. Pet. 54. Petitioner also asserts that the Kapton Website explicitly teaches that Kapton polyimide film meets the requirements of claim 7, and that it would have been obvious to a person of ordinary skill to use this material, particularly because Tzeng ’076 recommends using Kapton. *Id.* at 55 (citing Ex. 1020 ¶ 0050).

Patent Owner argues that the Kapton Website fails to provide any disclosure that would correct the cited deficiencies of the Norley Article, Tzeng ‘520, Mecuri, and the APA. Redacted PO Resp. 49.

Based on the preponderance of the evidence, we are persuaded that claim 7 would have been obvious based on the cited references.

5. Obviousness Based on the Norley Article, Tzeng '520, Mercuri, APA, and Mendolia

Claim 13 depends from claim 12 and further requires a reflective material positioned between the CPEG sheet and the keypad of the cell phone.

Petitioner asserts that Mendolia discloses such a reflective material. Petitioner concludes that it would have been obvious to a person of ordinary skill to use the reflective material in the structure suggested by the other references because Mendolia's conductive layer "blocks RF signals emanating from within the cellular phone . . . from reaching the user." Pet. 58 (quoting Ex. 1031, col. 2, ll. 42-44).

Mendolia discloses a keyboard for a portable communication device, such as a cellular telephone. Ex. 1031, col. 1, ll. 5-6. The keyboard includes a shielding layer added to the keypad to prevent radio frequency (RF) leakage. *Id.* at col. 1, ll. 8-9. The shielding layer includes an insulating layer and a conductive layer. *Id.* at col. 1, ll. 50-51.

Shielding 300 disclosed in Mendolia includes an insulating layer 310 made from a thin layer of rubber, flexible plastic, or any suitable insulating material, that adjoins the top surface of printed circuit board 200. *Id.* at col. 2, ll. 35-38. Insulating layer 310 prevents shorts from occurring. *Id.* at col. 2, ll. 38-39. Shielding 300 also includes conductive layer 320 made from nickel foil or its equivalent, which adjoins the top surface of insulating layer 310. *Id.* at col. 2, ll. 39-41. As explained in Mendolia:

> The conductive layer 320 serves a *dual purpose*. *First, it blocks RF signals* emanating from within the cellular phone (not

> shown) from reaching the user. *Second, it provides a shiny surface which reflects the light* from the LED's 560 up through the buttons 450 which increases the magnitude of light seen by the user. Furthermore, a small opening (not shown) may be made in the insulating layer 310 such that the conductive layer 320 comes into direct contact with the surface of the PCB 200 for grounding purposes.

Id. at col. 2, ll. 41-50 (emphases added).

Thus, because Mendolia discloses a reflective layer on the keyboard of a cell phone, the reflective material necessarily will be positioned between the keypad and other components of the cell phone.

Patent Owner asserts that nothing in Mendolia suggests the use of a CPEG sheet as a thermal shield in a cell phone. Redacted PO Resp. 50. As already noted, however, Petitioner relies on other references for the teaching of a CPEG thermal shield.

Based on the preponderance of the evidence, we are persuaded that claim 13 would have been obvious based on the cited references.

6. Obviousness Based on the Norley Article, the eGraf Technical Bulletin, Tzeng '520, Mercuri, APA, and Chauvel

Claim 16 depends from claim 15 and recites that the second component is a liquid crystal display.

The eGraf Technical Bulletin is cited by Petitioner because it "describes use of Exfoliated Graphite in 'communications devices,' and further that Exfoliated Graphite has highly anisotropic properties." Pet. 35, 43. Both of these elements have been established by other references, as discussed above.

Petitioner cites Chauvel as disclosing that cell phones have digital signal processors, batteries, a keypad, a case, and a liquid crystal display.

Pet. 43. Petitioner asserts that a person having ordinary skill in the art "would have been motivated" to apply the teachings of the Norley Article or the eGraf Technical Bulletin and Tzeng '520 to the cell phone in Chauvel because Chauvel concerns spreading and dissipating heat from components in a cell phone. Pet. 43-44.

Patent Owner asserts that eGraf Technical Bulletin and Chauvel fail to provide any suggestion or other disclosure that would correct the argued deficiencies of the Norley Article, Tzeng '520, Mercuri, and the APA references.

Chauvel discloses these basic elements in the context of an invention for dynamic energy management based on the temperature, or estimated temperature, of various areas of an electronic device. Ex. 1032 ¶ 9.

Based on the record before us, the preponderance of evidence establishes that claim 16 would have been obvious based on the cited references,

7. Objective Indicia of Non-obviousness

Objective criteria constitute independent evidence of non-obviousness. *Mintz v. Dietz & Watson, Inc.*, 679 F.3d 1372, 1378 (Fed. Cir. 2013). However, as discussed below, the objective indicia argued in the Redacted Patent Owner Response—industry praise (Redacted PO Resp. 53), commercial success (*id.* at 54), failure of others (*id.* at 57), and copying (*id.* at 58) do not establish a nexus with the claimed subject matter.

a. Industry Praise

Patent Owner cites a number of awards it received as evidence of industry praise for the invention. Redacted PO Resp. 54 (citing Ex. 2041–2044). Exhibit 2041 is a 2004 award from R&D Magazine in which Patent

Owner was recognized for a Spreadershield for Reducing Hot Spots in Consumer Electronic Devices. Ex. 2041, 3. Patent Owner does not, however, show how this award relates to the specific features claimed in the '441 patent.

Exhibit 2042 is a 2006 press release announcing that Frost & Sullivan recognized Patent Owner with the "2005 Excellence in Technology Award for its exceptional track record in providing industries with innovative natural graphite-based solutions for thermal management." Ex. 2042, 2. This award recognizes the "Spreadershield(TM) natural graphite heat spreaders." *Id.* at 1. Again, Patent Owner does not show how this award relates to the specific features claimed in the '441 patent.

Exhibit 2043 is an application brochure from the Ohio Department of Development with information concerning the 2006 Governor's Excellence in Exporting Award. We have not been directed to anything in Exhibit 2043 that relates to the claimed invention. Exhibit 2044 is a 2006 news release from the Office of the Governor of Ohio identifying "GrafTech International, Ltd., Advanced Energy Technology Inc." as one of 29 Ohio companies and organizations [recognized] with the Governor's Excellence in Exporting Award." Ex. 2044, 1. According to the news release, this award "recognizes Ohio companies that have increased sales volume through exports, increased Ohio-based employment as a direct result of export activity, or developed and implemented a strategy to expand their international sales." *Id.* We have not been directed to anything in Exhibit 2044 that relates to the claimed invention.

Patent Owner asserts that this industry praise is "praise for the invention claimed in the '520 Patent." Redacted PO Resp. 54.

As discussed above, however, Patent Owner has not demonstrated a specific nexus between these awards and the claimed subject matter.

b. Commercial Success

Patent Owner asserts that the "claimed thermal management systems have been employed in cellular telephones, tablet devices, laptop computers, and televisions in a manner that satisfies the limitations of Claims 1, 4, 5, 11, and 14 of the '441 Patent." Redacted PO Resp. 56 (citing Ex. 2005 ¶¶ 271–284. . Dr. Culham opines that the products he analyzed satisfies the limitations of at least one of the challenged claims. *See, e.g.*, Ex. 2005 ¶ 284.

The Declaration of Phillip Green, submitted by Patent Owner, provides an analysis of commercial success. Mr. Green concludes that "[p]roducts manufactured and sold by GrafTech that enable the use in consumer electronic products of the systems embodied by the challenged claims are commercially successful." Ex. 2034 ¶ 9. Mr. Green's opinion is based, in part, on substantial sales of Patent Owner's Spreadershield products. *Id.* ¶ 34. The Declaration of Richard Feinberg, Ph.D., submitted by Petitioner, disputes Mr. Green's conclusions. Ex. 1035 ¶ 22.

Petitioner asserts that the evidence on which Patent Owner relies "fails to show a nexus to alleged commercial success." Reply 11.

In order to establish a proper nexus, the patent owner must offer proof that the sales were a direct result of the unique characteristics of the claimed invention—as opposed to other economic and commercial factors unrelated to the quality of the patented subject matter. *Microsoft v. Proxyconn, Inc,.* IPR2012-00026, slip op. at 4 (PTAB Mar. 8, 2013) (Paper 32). We have considered Patent Owner's evidence and arguments, but are not persuaded

that Patent Owner has established that the commercial success claimed is a result of the claimed invention.

Based on the totality of the evidence, we are not persuaded that the evidence concerning the commercial success of the devices identified by Patent Owner, or the commercial success of Patent Owner's products in these devices, establishes the requisite nexus.

c. Failure of Others

Patent Owner asserts that the "failure of others to arrive at the invention of the challenged claims despite the availability of the material and the desire for improved thermal management solutions is further evidence of the nonobviousness of the challenged claims." Redacted PO Resp. 57–58. In Dr. Culham's opinion, the "failure of others to utilize CPEG sheet material as a simultaneous thermal spreader and thermal shield in portable electronic devices suggests that the invention of the '441 Patent was not obvious to persons of ordinary skill." Ex. 2005 ¶ 287. We note that Tzeng '520 and Norley disclose a thermal management solution using CPEG sheet material in an electronic device, contrary to Patent Owner's assertions. We determine that the evidence does not establish a failure of others.

d. Copying

Patent Owner asserts that Beichuan (a Hong Kong manufacturer of flexible graphite sheets) and G&CS (a South Korean manufacturer of flexible graphite sheets) have copied its flexible CPEG sheets, and those sheets "are being marketed for use in thermal management systems according to the '520 Patent."[11] Redacted PO Resp. 59 (citing Ex. 2005

[11] We assume Patent Owner intended to refer to the '441 patent, the subject of this proceeding, and proceed in our analysis accordingly.

¶¶ 292–299; Ex. 2049–2051). Dr. Culham opines that "[g]iven the description of the properties these [copy] products possess, it is likely that Beichuan's GTS product *is a CPEG sheet product*." Ex. 2005 ¶ 296 (emphasis added). The challenged claims, however, do not cover a "CPEG sheet product"; they are more limited, as discussed above.

Dr. Culham makes a similar statement for the G&CS product, stating it is likely a "graphite sheet product made of CPEG sheet material." *Id.* ¶ 298. The challenged claims do not cover merely a graphite sheet product made of CPEG sheet material. The challenged claims cover a specific thermal dissipating and shielding system, including a heat source.

Accordingly, we are not persuaded that there is sufficient evidence of copying.

Thus, the objective evidence, considered with the other evidence in this proceeding, does not tip the balance in favor of the Patent Owner. The totality of the evidence on which we have relied persuades us that a preponderance of the evidence establishes that the challenged claims are not patentable.

III. MOTION TO EXCLUDE

Patent Owner has moved to exclude Exhibits 1015, 1017, 1036-1044, 1046–1071, and 1073–1094 for failure to satisfy the requirements for relevance, authentication, and/or hearsay. With few exceptions, the Federal Rules of Evidence apply to inter partes proceedings. 37 CFR § 42.62. The moving party has the burden of proof to establish that it is entitled to the requested relief. 37 C.F.R. § 42.20(c), 42.62(a).

We have considered the parties arguments and evidence and deny the Motion to Exclude Exhibits 1015 and 1017, and dismiss the Motion to Exclude as moot with respect to the remaining exhibits.

A motion to exclude after lodging a proper objection is an appropriate mechanism for challenging the admissibility of evidence, but is not an appropriate mechanism for challenging the sufficiency of evidence or the proper weight that should be afforded an argument. Our general approach for considering challenges to the admissibility of evidence was outlined in *Corning Inc. v. DSM IP Assets B.V.*, Case IPR2013-00053, slip op. at 19 (PTAB May 1, 2014) As stated in *Corning*, similar to a district court in a bench trial, the Board, sitting as a non-jury tribunal with administrative expertise, is well-positioned to determine and assign appropriate weight to evidence presented. *See, e.g.*, *Donnelly Garment Co. v. NLRB*, 123 F.2d 215, 224 (8th Cir. 1941) ("One who is capable of ruling accurately upon the admissibility of evidence is equally capable of sifting it accurately after it has been received . . . .").

All but two of the exhibits, Exhibits 1015 and 1017, that Patent Owner moves to exclude have not been relied upon in our substantive analysis of the merits of this proceeding. Thus, in this *inter partes* review, we dismiss the Motion to Exclude as moot as to all such exhibits. We discuss below our denial of the Motion with respect to Exhibits 1015 and 1017.

A. Exhibit 1015

Exhibit 1015 consists of three pages. Page 1 is a letter dated January 12, 2001, on the letterhead of GrafTech. The letter is dated January 12, 2001. It is addressed to Don Szysh, at KAPCO in Kent, Ohio. The letter is signed by Brian Fedor, who has the title "ETM Sales Engineer." Ex. 1015,

1. Page 2 is a one-page Technical Bulletin on the letterhead of eGraf Electronic Thermal Management Products for eGraf™ Class 700 Thermal Interface. It provides information on properties, applications, performance, and availability. The bottom of the page identifies "Graftech Inc." and provides phone numbers for Graftech. It bears a copyright notice of 2001 in the name of Graftech Inc. Page 3 is similar to page 2, but for the eGraf™ Class 1200 Thermal Interface. In addition to having the same identifying information as page 2, page 3 states it was "Issued January 8, 2001," and that it is "Revision A." All three pages indicate that they also were sent by facsimile on January 16, 2001, to an unidentified facsimile number.

Patent Owner objects based on relevance, authentication, and hearsay. Mot. Excl. 4–5.

1. Relevance

Patent Owner asserts that Exhibit 1015 is not relevant because the "eGraf Technical Bulletin" fails to demonstrate "even a remote suggestion of using CPEG sheet as a thermal shielding material. Instead, the passages to which Laird cites demonstrate the use of CPEG sheet as a heat conducting material, such as a heat spreader or TIM." Mot. Excl. 4 (citing Ex. 2005 ¶ 266).

Petitioner asserts that Patent Owner is misusing the motion to exclude procedure "to challenge the sufficiency of the evidence to prove a particular fact." Resp. Mot. Excl. 6.

A Motion to Exclude after lodging a proper objection is an appropriate mechanism for challenging the admissibility of evidence, but is not an appropriate mechanism for challenging the sufficiency of evidence or the proper weight that should be afforded an argument. As stated in *Corning*

Inc. v. DSM IP Assets B.V., Case IPR2013-00053, slip op. at 19 (PTAB May 1, 2014), similar to a district court in a bench trial, the Board, sitting as a non-jury tribunal with administrative expertise, is well-positioned to determine and assign appropriate weight to evidence presented. *See, e.g.*, *Donnelly Garment Co. v. NLRB*, 123 F.2d 215, 224 (8th Cir. 1941) ("One who is capable of ruling accurately upon the admissibility of evidence is equally capable of sifting it accurately after it has been received . . . .").

Evidence is relevant if it has any "tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence." Fed. R. Evid. § 401. The Federal Circuit recognizes that there is a "low threshold for relevancy." *OddzOn Products, Inc. v. Just Toys, Inc*., 122 F. 3d 1396, 1407 (Fed. Cir. 1997). In the context of obviousness, two criteria are helpful in determining whether prior art is analogous: (1) whether the art is from the same field of endeavor, regardless of the problem addressed, and (2) if the reference is not within the field of the inventor's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved. *Wyers v. Master Lock Co.*, 616 F.3d 1231, 1237 (Fed. Cir. 2010).

As discussed above, the challenged claims relate to a "thermal dissipation and shielding system for a cell phone." Exhibit 1015 relates to thermal interface materials made from natural graphite that have different thermal conductivity in the through-plane and in-plane dimensions and which provide effective heat transfer.

The Supreme Court informs us that familiar items may have obvious uses beyond their primary purposes, and in many cases a person of ordinary

skill will be able to fit the teachings of multiple patents or other prior art references together "like pieces of a puzzle." *KSR*, 550 U.S. at 420. We determine Exhibit 1015 is relevant and are not persuaded by Patent Owner's argument, which goes to the weight of the evidence rather than its admissibility.

2. Authentication

Petitioner relied upon Richard Hill, Ph.D. to authenticate Exhibit 1015. Exhibit 1009 ¶ 16. Dr. Hill is a Vice President of Petitioner, and has been in that position since 2004. Ex. 1009 ¶¶ 3, 7. Dr. Hill stated that Exhibit 1015 "is a true and correct copy of the GrafTech Letter (dated January 12, 2001) and an eGraf Technical Bulletin received via facsimile on January 16, 2001. The GrafTech Letter and eGraf Technical Bulletin was kept by Laird Technologies in the ordinary course of business as a business record as a part of its competitive intelligence efforts." *Id.* ¶ 16. Dr. Hill testified at his deposition that he personally received Exhibit 1015. Ex. 2030, 44:4–14. We find Dr. Hill's testimony credible, and we are satisfied that Exhibit 1015 is an authentic copy of the eGraf Technical Bulletin and an accompanying letter received in 2001 and kept by Laird (Petitioner) in the ordinary course of its business.

3. Hearsay

Patent Owner asserts Ex. 1015 is hearsay because "it reflects statements regarding eGraf products that a GrafTech representative or author did not make while testifying in this IPR offered by Laird to prove the truth of the assertions in the statements." Mot. Excl. 5.

Petitioner asserts that documentary evidence is not hearsay if it is not offered to prove the truth of the matter asserted in the document. Resp. Mot.

Excl. 3. A prior art document submitted as a printed publication under 35 U.S.C. § 102(b) is offered simply as evidence of what it described, not for proving the truth of the matters addressed in the document, and, thus, is not hearsay. *EMC Corp. v. Personal Web Technologies, LLC*, Case IPR2013-00085, slip op. at 66 (Paper 73 May 15, 2014); *see also* Fed. R. Evid. 801(c) 1997 Adv. Comm. Note ("If the significance of an offered statement lies solely in the fact that it was made, no issue is raised as to the truth of anything asserted, and the statement is not hearsay.").

Accordingly, we deny the motion to exclude Exhibit 1015.

B. Exhibit 1017

Exhibit 1017 is an Affidavit from Christopher Butler stating that Exhibit A attached to the Affidavit is a true and correct copy of a printout of the Internet Archive's records for the Exhibit A document. Exhibit A is a 2-page document titled "Kapton Polyimide Film Specifications" (i.e., purportedly the Kapton Website).

Patent Owner asserts it is not relevant because it does not relate to CPEG (Mot. Excl. 6); it is not authenticated by a "Laird declarant [who] has personal knowledge of the actual and complete content of the Kapton Website" (*id.* at 7); and it is hearsay because the author of the content of the Exhibit "did not make [the statements] while testifying in this IPR" and because it is offered by Laird to prove the truth of the assertions in the statements" (*id.* at 8).

For similar reasons as in our discussion of Exhibit 1015, we are not persuaded Exhibit 1017 is irrelevant or hearsay. As to authentication, based on the evidence presented by Petitioner, we are persuaded Exhibit 1017 is an authentic copy of the Kapton Website in the form it was available to skilled

artisans as of the critical date of the '441 Patent. Accordingly, we deny the motion to exclude Exhibit 1017.

IV. CONCLUSION

Based on the evidence and arguments, Petitioner has demonstrated by a preponderance of the evidence that claims 1–16 of the '441 patent are unpatentable under 35 U.S.C. § 103(a)

IV. ORDER

In consideration of the foregoing, it is hereby

ORDERED that, based on Petitioner's showing by a preponderance of the evidence, claims 1–16 are unpatentable;

FURTHER ORDERED, that Petitioner's Motion to Exclude is DENIED with respect to Exhibits 1015 and 1017, and DISMISSED with respect to all other exhibits identified in the Motion.

This is a final decision. Parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

A protective Order has been entered in this proceeding. Paper 28. We remind the parties of the expectation that confidential information relied upon in a decision to grant or deny a request to institute or identified in a final written decision will be made public. Office Trial Practice Guide, 77 Fed. Reg. 48756, 48760 (Aug. 14, 2012). Confidential information that is subject to a protective order ordinarily becomes public 45 days after denial of a petition to institute or 45 after final judgment in a trial. A party seeking to maintain the confidentiality of the information may file a motion to expunge the information from the record prior to the information becoming public. 37 C.F.R. § 42.56.

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