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Paper 46
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 IPR2014-00024
Patent 6,982,874 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 1–20 of U.S. Patent No. 6,982,874 B2 ("the '874 patent"). Paper 7 ("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, 11, 14, 15 and 20 over Norley (Ex. 1021), Tzeng '520 (Ex. 1004), and Mercuri (Ex. 1023);

B. claims 2, 3, 8, 9, 12, 13, 18, and 19 over Norley, Tzeng '520, Mercuri, and Richey (Ex. 1018);

C. claims 6 and 16 over Norley, Tzeng '520, Mercuri, and Tzeng '076 (Ex. 1020); and

D. claims 7 and 17 over Norley, Tzeng '520, Mercuri, Tzeng '076, and the Kapton Website (Ex. 1017).

See Decision on Institution of Inter Partes Review, Paper 11 ("Dec. to Inst.").

GrafTech International Holdings, Inc. ("Patent Owner") filed a Confidential Patent Owner Response (Paper 22, "Confidential PO. Resp.") and a Redacted Patent Owner Response (Paper 21, "Redacted PO Resp."). Petitioner filed a Reply (Paper 29, "Reply").

We granted Patent Owner's motion to seal Exhibits 2034–2040, 2047, 2053–2063, and 2074–2091 (collectively, the "Sealed Exhibits") and portions of the Patent Owner Response. Paper 28.

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 39, "Resp. to Mot. Excl."), and Patent Owner's Reply (Paper 41, "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 38).

An oral hearing was held on December 15, 2014. A transcript of the hearing is included in the record. Paper 45 ("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 1–20 are unpatentable.

A. The '874 patent

The challenged claims of the '874 patent relate generally to a heat dissipating and heat shielding system for an electronic device. Ex. 1001, col. 3, ll. 61–64; *see also* claim 1, col. 16, ll. 32–33 ("A thermal dissipation and shielding system for an electronic device"). The system uses a "thermal solution" to provide the heat dissipating and heat shielding functions. *Id.* The "inventive thermal solution" is an anisotropic sheet of compressed particle of exfoliated graphite (also referred as "flexible graphite"). *Id.* at col. 3, ll. 64–67. Compressed particles of exfoliated graphite are referred to generally by the acronym "CPEG." Redacted PO Resp. 1.

Anisotropic materials preferentially transfer heat in selected directions. Ex. 1001, col. 2, ll. 9–11. The thermal anisotropy of a material is defined by the material's in-plane and through-plane thermal conductivities. Ex. 2005 ¶ 70. 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.

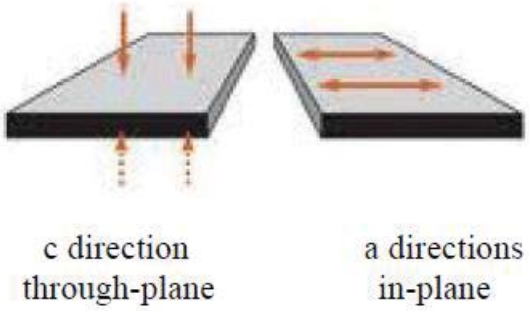

Illustration from Ex. 2005 ¶ 70 showing
"c-direction" through plane and
"a-direction" in-plane thermal conductivity.

To be anisotropic with regard to thermal conductivity, a material's through-plane and in-plane thermal conductivities *must* be different. *Id.* ¶ 71. If they were the same, the material would be thermally isotropic. *Id.*; *see* Ex. 1001, col. 13, ll. 30–37.

As explained in the '874 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. 61–64. 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 '874 patent has an in-plane thermal conductivity substantially higher than its through-plane thermal conductivity. Ex. 1001, col. 4, ll. 2–5. Preferably, the anisotropic CPEG sheet has a thermal anisotropic ratio on the order of 10 or greater. *Id.* at col. 4, ll. 5–7. The thermal anisotropic ratio is the ratio of in-plane thermal conductivity to

through-plane thermal conductivity. *Id.* at col. 4, ll. 8–9. Different applications require, or benefit from, different levels of thermal conductivity and thermal conductivity ratios. Ex. 2005 ¶ 74.

Anisotropic CPEG sheets are well-known in the prior art. Redacted PO Resp. 6 (citing Ex. 1004); *see also* Ex. 1001, col. 7, ll. 18–20 (citing U.S. Patent No. 3,404,061 ("Shane"), which is Ex. 1013 in this proceeding). Shane is incorporated by reference into the '874 patent. Ex. 1001, col. 7, ll. 18–20.

B. Exemplary Claim

Claims 1 and 11 of the '874 patent are independent claims. Both challenged independent claims are directed to a thermal dissipating and shielding system. Claim 1, shown below, is illustrative:

> 1. A thermal dissipation and shielding system for an electronic device, comprising:
>
> an electronic device comprising a first component which comprises a heat source, wherein the first component transmits heat to an external surface of the electronic device;
>
> a thermal solution comprising two major surfaces, the thermal solution positioned such that one of its major surfaces is in operative contact with the first component such that it is interposed between the first component and the external surface of the electronic device,
>
> 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.

Independent claim 11 is similar to claim 1, but also requires a "second component," and further requires the CPEG sheet to be interposed between the first component and the second 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).

Shane is not a reference applied by Petitioner against the claims to establish unpatentability. Shane, however, is an important and substantive piece of admitted prior art that establishes the basic characteristics of the CPEG material used in the claimed invention and known in the art. Shane provides a "roadmap" of how to use CPEG. Dec. to Inst. 9; *see* Redacted PO Resp. 37.

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. 46 ("Shane does disclose a process for producing CPEG sheet material and does discuss the anisotropic thermal properties of a CPEG sheet."). The graphite sheet in Shane has "excellent flexibility" and "good strength." *Id.* at 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.

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").[1] *Id.* at col. 13, ll. 2–11; *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 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.

Patent Owner admits that Shane discloses the anisotropic thermal properties of CPEG sheets. Redacted PO Resp. 37. Patent Owner also

[1] "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.

admits that, in view of these anisotropic properties, Shane discloses that CPEG sheets "can be employed as either a thermal conductor or a thermal insulator." *Id.* Thus, there is no dispute that Shane "teaches a person skilled in the art about CPEG sheet, its basic properties, and methods by which it can be made." Redacted PO Resp. 37. Dr. Richard Culham, Patent Owner's declarant, essentially repeats Patent Owner's assertions. Ex. 2005 ¶ 148. 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.* ¶¶ 149, 153.

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 make 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 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. 18 (citing Ex. 1012 ¶ 18).[2]

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

[2] 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.

that asserted by Petitioner.[3] Redacted PO Resp. 18 (citing Ex. 2005 ¶¶ 122–125). In Dr. Culham's opinion, a person of ordinary skill in the art in the field of the '874 patent would be one with at least a Bachelor's degree in an engineering discipline (such as mechanical engineering or electrical 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

[3] 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.

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 10.

Patent Owner submits that five phrases from the challenged claims of the '874 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. 19–20.

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 claims 1 and 11 ("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 electronic device further comprises a heat dissipation device . . . .").

Patent Owner proposes that the broadest reasonable interpretation of the phrase "thermal dissipation" as used in the '874 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. 19 (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 '874 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. 35–39. 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 '874 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 claims 1 and 11 ("A thermal dissipation and shielding system").

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[4] 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. 19. According to Patent Owner, the disclosure of the '874 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.* (citing Ex. 2005 ¶¶ 135–37). This 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*

[4] "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.

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 "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."[5]

Accordingly, the broadest reasonable construction in light of the Specification of the claim term "thermal shields" or "thermal shielding," or its grammatical variants, is a structure that protects against heat.

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

3. Thermal Dissipation and Shielding System

The phrase "thermal dissipation and shielding system" appears only in the preamble of independent claims 1 and 11.

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. 20. 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 '874 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. 20.

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 concludes 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 an electronic device may be positioned between a heat source and an external surface of the electronic device, where the thermal solution facilitates heat dissipation from the heat source while shielding the external surface 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 '874 patent of the phrase "heat source" simply is a source of heat.[6]

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. 20 (emphasis added). Essentially, the Patent Owner wants to add the word "natural" into the claims. Patent Owner cites to claims 1 and 11 for support, but the cited passages do *not* contain any reference to the word "natural" when referring to the claimed graphite

[6] "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).

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 three 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 of intercalating organic and inorganic acids as well as halogens and then expanding when exposed to heat." Ex. 1001, col. 6, ll. 44–47. 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. 6, l. 65–col. 7, l. 4 (emphases added). Thus, through its proposed construction, Patent Owner tries to include a preferred element from the Specification into the claims. This is not permitted. "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." *KSR*, 550 U.S. 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, and Mercuri

Petitioner asserts that claims 1, 4, 5, 10, 11, 14, 15, and 20 are unpatentable under 35 U.S.C. § 103(a) based on Norley, Tzeng '520, and Mercuri. Petitioner asserts that the Norley Article "demonstrates that Exfoliated Graphite[7] is useful as a heat shield"; Mercuri also "discloses the use of Exfoliated Graphite for use in thermal shielding applications"; and Tzeng '520 discloses a CPEG sheet in contact with a heat source in an

[7] Petitioner uses the term "Exfoliated Graphite" to refer to compressed particles of exfoliated graphite (i.e., CPEG). *See* Pet. 1.

electronic device. Pet. 22. According to Petitioner, based on the disclosures of the cited references, it would have been obvious to a person of ordinary skill in the relevant technology to make design choices to use the known anisotropic properties of CPEG, disclosed in Norley, to channel heat in a preferred direction to manage heat generated by electronic components, as suggested by Tzeng '520, and to provide effective thermal shielding, as suggested by either Norley or Mercuri. Pet. 27–31.

Patent Owner takes a different view of the cited references. Patent Owner asserts that Norley "in no way relates to thermal shields" (Redacted PO Resp. 23); that Mercuri only "utilizes a CPEG sheet as a heat dissipater" (*id.* at 29); that Tzeng '520 "provides no motivation to use a CPEG sheet as a thermal shield" (*id.* at 33); and that Shane "fails to remedy the deficiencies of the references" (*id.* at 37). The basis of Patent Owner's criticism of the asserted references, as well as the background prior art disclosed in Shane, is that the "distinction between a thermal dissipater and thermal shield is in no way trivial. In fact, thermal dissipaters and thermal shields are essentially polar opposites of one another." *Id.* 1. Patent Owner also asserts that:

> none of the references even remotely suggests the use of a CPEG sheet as a thermal shield material, much less as an apparatus that simultaneously dissipates heat from a heat source while thermally shielding a second component or external surface of the device from heat generated by a heat source.

Id. at 5 (citing Ex. 2005 ¶¶ 26–31, 292).

Notwithstanding its criticism of Shane and the other references disclosing an anisotropic graphite material, Patent Owner concedes that Shane discloses "the anisotropic thermal properties of CPEG sheet, indicating that '[i]t possesses either low or high thermal conductivity,

dependent upon the orientation." Redacted PO Resp. 37. Patent Owner also concedes Shane discloses that, "in view of these materials' anisotropic properties, they can be employed as either a thermal conductor or a thermal insulator." *Id.* Dr. Culham, Patent Owner's Declarant, agrees with Patent Owner's statements. Ex. 2005 ¶ 148.

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 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. Petitioner also asserts that the same CPEG material disclosed in Tzeng '520 is the CPEG material disclosed in the '874 patent, Shane, and recited in the challenged claims. *Id.* at 3–4. Petitioner concludes that "if CPEG in the later '874 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.

a. Independent Claims 1 and 11

Independent claim 1 requires an electronic device having a heat source, and a CPEG sheet, in contact with the heat source, and interposed between the heat source and an external surface of the electronic device. The stated function of the CPEG sheet is that it "thermally shields" the external surface 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 in contact with a heat source, wherein the CPEG sheet protects the external surface of an electronic device from the heat generated by the heat source.

Claim 11 recites that the electronic device includes a first component, which is a heat source, and a second component. Claim 11 further recites that the CPEG sheet is positioned such that one of its major surfaces is in operative contact with the first component and "such that it [the CPEG sheet] is interposed between the first component [the heat source] and the second component."

Thus, in claim 1 the CPEG sheet protects an external surface of the electronic device, whereas in claim 11 the CPEG sheet protects a "second component" of the electronic device.

Except for the preamble, neither independent claim 1 nor independent claim 11 recites any structure or function relating to dissipating heat. These claims require only that the CPEG sheet "thermally shields" or protects against heat. The claims do not quantify the type or amount of protection provided by the CPEG sheet.

The issue presented by the parties' differing interpretation of the references is whether anisotropic CPEG functions as a thermal 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 simultaneously for 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 can be used as a heat dissipation device to spread heat from a local hotspot over a larger area, which is fundamentally different than heat shielding. As we noted above, the broadest reasonable interpretation of thermal shielding, as required in claim 1, is simply protection from heat generated by a heat source.

Petitioner asserts that a person having ordinary skill in the art would have combined Norley and Tzeng ’520 and, as a matter of mere design choice, used Exfoliated Graphite between two components in a laptop or other electronic device. Pet. 32 (citing Ex. 1012 ¶¶ 41–45, 113–122). Petitioner also asserts that the person having ordinary skill in the art would have been motivated to position an Exfoliated Graphite sheet (as in the Norley Article or Tzeng ’520 patent) between a heat source (first component) and a heat-sensitive component (second component). Ex. 1012 ¶ 41–44. Upon consideration of the evidence, we agree with Petitioner’s contentions.

b. Claims 4, 5, 10, 14, 15, and 20

Dependent claims 4, 5, 14, and 15 recite specific thermal conductivity values or a specific type of electronic component or device. The “in-plane thermal conductivity of at least about 140 W/m°K,” called for in claims 4

and 14 is disclosed in the Norley Article and Tzeng '520, as asserted by Petitioner. Pet. 33–34; Ex. 1021, 3; Ex. 1004, col. 4, ll. 24–38. 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 claims 5 and 15. *Id*.

Claim 10 limits claim 1 to require that the electronic device is a "laptop computer" and the claimed "external surface of the electronic device" is "a portion of a laptop computer case." Ex. 1001, col. 17, ll. 6–8. Claim 20 limits claim 11 to require that the first component (heat source) comprises the hard drive of the laptop, and the second (protected) component comprises the chipset of a laptop computer. *Id.* at col. 18, ll. 22–25. Petitioner asserts that Norley discloses notebook computers, which inherently have an external surface comprising a laptop computer case, as well as a hard drive and chipset. Pet. 35 (citing Ex. 1021, 1; Ex. 1012 ¶¶ 48–49). Petitioner asserts that a person of ordinary skill in the art would have recognized the benefit of protecting the chipset from the heat generated by the hard drive in accordance with the teachings of Tzeng '520. *Id.* (citing Ex. 1012 ¶ 49). Petitioner further asserts a skilled artisan would also have understood that the CPEG disclosed in the Norley Article and Tzeng '520 easily could be positioned to carry heat away from, and shield, the chipset. *Id.* Patent Owner does not identify any heat dissipating or shielding problems that are unique to laptop or notebook computers.

Based on the preponderance of the evidence, we are persuaded that claims 1, 4, 5, 10, 11, 14, 15, and 20 would have been obvious based on the cited evidence.

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

Petitioner asserts that claims 2, 3, 8, 9, 12, 13, 18, and 19 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, depending from claim 1, and claim 12, depending from claim 11, each recite the same heat dissipation limitations—"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."

As shown in Figure 1 below from the '874 patent, one of the major surfaces 10a or 10b of "thermal solution 10" (i.e., the CPEG sheet) is in operative contact with a heat dissipation device 110, such as a heat sink, heat pipe, or heat plate, which is positioned apart from first component 100. Ex. 1001, col. 14, ll. 40–43.

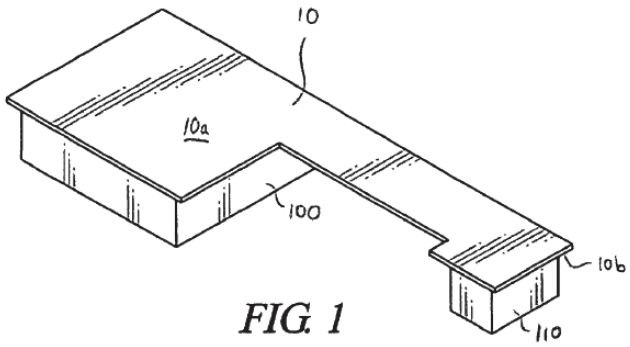

FIG. 1

Fig. 1 of Ex. 1001 is a perspective view of a CPEG sheet bridging a heat source and a heat sink.

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.

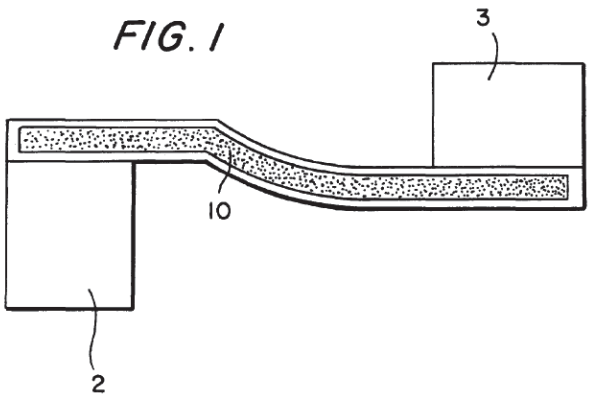

Fig. 1 of Ex. 1018 is a cross-sectional view of a heat transfer device shown connected between a heat source and a heat sink.

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

Petitioner asserts it would have been obvious to a person having ordinary skill in the art, based on Richey's teaching, 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. 39–40. According to Petitioner, a person having ordinary skill in the art would have recognized the advantages of being able to place a heat sink at a location away from the heat source based on the preferred configuration or aesthetic

design of the laptop, as taught by Richey. Pet. 40 (citing Ex. 1012 ¶ 60). Richey addresses the issues of cost to remove heat in space constrained areas where thermal management by conduction requires a material that can be easily configured to provide a low-density, flexible, thin cross-section for the movement and redistribution of heat loads from heat-sensitive electronic components. Ex. 1018, col 1, ll. 33–39, col. 3, ll. 49–52. Petitioner asserts that a person having ordinary skill in the art would have been motivated to use the teachings of Richey to use the Exfoliated Graphite sheets described in the Norley Article and Tzeng '520 to transfer heat from the heat source to the heat sink. *Id.* (citing Ex. 1012 ¶ 61). Mr. Bagot opined that a person having ordinary skill in the art would have been motivated, with a reasonable expectation of success, to use the teachings of Richey to add a heat sink to the laptop and then use a CPEG material to transfer heat from the heat source to the heat sink. Ex. 1012 ¶ 61. Upon consideration of the evidence, we agree with Mr. Bagot's conclusions.

a. Claims 3 and 13

Regarding claims 3 and 13, which specify a "heat sink, a heat pipe, [or] a heat plate" as a heat dissipation device, Richey discloses use of a heat sink as a heat dissipation device. *See, e.g.*, Ex. 1018, col. 3, ll. 49–51.

b. Claims 8 and 18

Claims 8 and 18 specify a "thermal transfer material" between the CPEG sheet and the heat source. Richey 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. 8–11. 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. 11–13. The 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. Since the foil strips have high thermal conductivity, we conclude they constitute a thermal transfer material located between the CPEG 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 the 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 heat transfer device 10 independent of core material composition 12. *Id*. Based on the evidence of record, we agree with Petitioner's contentions as to claims 8 and 18.

c. Claims 9 and 19

Claim 9, depending from claim 8, and claim 19, depending from claim 18, each recite the same limitation—"wherein 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, and Mercuri." 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.

Based on the preponderance of the evidence, we are persuaded that claims 2, 3, 8, 9, 12, 13, 18, and 19 would have been obvious based on the

cited evidence.

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

Dependent claims 6 and 16 each recite that the CPEG sheet further comprises a protective coating thereon.

Petitioner asserts that Tzeng '076 discloses a protective coating, as called for in claims 6 and 16. Tzeng '076 relates to thermal management in the design of electronic products because of the need for heat dissipation from microelectronic devices used in these products. Ex. 1020 ¶ 3. Tzeng '076 discloses a thermal interface capable of being mounted to the external surface of a heat source, such as an electronic component, where the thermal interface comprises an anisotropic flexible graphite sheet, with at least one of the major surfaces of the graphite sheet having a protective coating sufficient to inhibit flaking of the particles of graphite. *Id.* ¶¶ 0011, 0044. Tzeng '076 discloses that the protective coating may be any 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.* ¶ 0044. Petitioner asserts it would have been obvious to combine the coating of Tzeng '076 with the Norley Article, Tzeng '520, and Mercuri, because a person having ordinary skill "would have been put in possession of the system of claims 6 and 16." Pet. 44. This conclusory statement provides no reasoning or analysis as to why a skilled person would combine the references as proposed.

Petitioner, however, also asserts that a skilled person would be motivated to combine the references because "they were all created by the same company – Patent Owner – and because they are all directed to heat

management in electronic devices." *Id.* "[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *KSR*, 550 U.S. at 418 (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). The obviousness analysis, however, 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. *Id.* Petitioner's proposed rationale is consistent with Norley, which discloses that CPEG provides 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. Ex. 1021, 4.

Based on the prior art, Petitioner's rationale, and the inferences and creative steps of a person of ordinary skill, we are satisfied that Petitioner provides the requisite articulated reasoning with rationale underpinning to support the proposed combination of references.

Patent Owner asserts that "Tzeng '076 fails to provide any suggestion or other disclosure that would correct the cited deficiencies of the Norley Article, Tzeng '520, and Mercuri." Redacted PO Resp. 49. As we noted above, the asserted combination of the Norley Article, Tzeng '520, and Mercuri does not have the "deficiencies" alleged by Patent Owner.

Based on the preponderance of the evidence, we are persuaded that claims 6 and 16 would have been obvious based on the cited references.

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

Dependent claims 7 and 17 each require that "the protective coating has a thermal conductivity less than the through-plane thermal conductivity of the at least one sheet of compressed particles of exfoliated graphite." Neither claim 7 nor claim 17 states a numeric value of the through-plane thermal conductivity of the CPEG sheet.

The Specification of the '874 patent states that 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." Ex. 1001, col. 15, ll. 39–43. The '874 patent further explains that a "plastic" protective coating has a thermal conductivity less than the through-plane thermal conductivity of the at least one sheet of flexible graphite. *Id.* at col. 5, ll. 53–57. The '874 patent Specification identifies "Kapton polyimide materials" as a suitable coating. *Id.* at col. 15, l. 61. Thus, based on the Specification, Kapton, a material commercially available from Du Pont (*see* Ex. 1001, col. 15, ll. 57–63) is a coating that meets the claim limitation in claims 7 and 17.

Petitioner asserts that the Kapton Website discloses the protective coating material called for in claims 7 and 17. Pet. 44–45; *see* Ex. 1017, 5. Petitioner also asserts that the rationale for using the protective coating material is provided by Tzeng '076, which discloses the same protective coating disclosed and called for in claims 7 and 17. *Id.*; *see* Ex. 1020 ¶¶ 0044, 0050.

Patent Owner argues that this ground of unpatentability should fail "for the same reasons discussed in detail" for the first asserted ground of unpatentability. We do not find this argument persuasive, for the reasons discussed above.

Based on the preponderance of the evidence, we are persuaded that claims 7 and 17 would have been obvious based on the cited references.

5. 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 '874 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 '874 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 '[874 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, 14, and 15 of the '874 Patent." Redacted PO Resp. 55. These products include Apple iPhones (*id.*; Ex. 2005 ¶ 245), Amazon Kindle Fire HD (Redacted PO Resp. 55; Ex. 2005 ¶ 249), Sony Vaio P Laptop Computer

(Ex. 2005 ¶ 253), and LG Curve OLED Television (*id.* ¶ 256). Dr. Culham opines that the products he analyzed satisfy the limitations of at least one of the challenged claims. *See*, *e.g.*, Ex. 2005 ¶ 257 ("It is therefore my opinion that this application of GrafTech CPEG sheet material in the LG Curve television satisfies the limitations of Claim 1 of the '874 Patent.").

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.*, Case 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. 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 '874 Patent was not obvious to persons of ordinary skill." Ex. 2005 ¶ 262. 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 ['874 patent]." Redacted PO Resp. 58 (citing Ex. 2005 ¶¶ 267–274; 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 ¶ 271 (emphasis added). The challenged claims, however, do not cover a "CPEG sheet product"; they are more limited.

Dr. Culham makes a similar statement for the G&CS product, stating it is a "natural graphite flake graphite sheet," and is a "graphite sheet product made of CPEG sheet material." 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 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 C.F.R. § 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 Exhibit 1017, and dismiss the Motion to Exclude as moot with respect to the remaining exhibits.

The exhibits Patent Owner moves to exclude have not been relied upon in our substantive analysis of the merits of this proceeding, except for Exhibit 1017. 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 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."

Patent Owner asserts it is not relevant because it does not relate to CPEG (Mot. Excl. 4); it is not authenticated by a "Laird declarant [who] has personal knowledge of the actual and complete content of the Kapton Website." (*id.* at 5); 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 6).

A. Relevance

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).

Exhibit 1017 relates to insulation films. Mr. Bagot explained the Kapton Website's relevance in his Declaration. Ex. 1012, ¶¶ 69–73.

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. The idea that a person of ordinary skill would ignore Exhibit 1017 as irrelevant because it does not specifically relate to CPEG claims is not persuasive.

B. Authentication

Exhibit 1017 was authenticated by Christopher Butler, who stated that that it is a true and correct copy of a printout of the Internet Archive's records. The fact that "no [Petitioner] declarant has personal knowledge of the actual and complete content of the Kapton Website," as asserted by Patent Owner, does not establish that it lacks authentication.

C. Hearsay

Patent Owner asserts Ex. 1017 is hearsay because the author did not make the statements while testifying in this IPR, and because it is offered to prove the truth of the assertions in the statements. Mot. Excl. 6.

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. to Mot. Excl. –8. A prior art document submitted as a printed publication under 35 U.S.C. § 102(b) is offered simply as evidence of what it describes, 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.").

Based on the analysis above, we are persuaded that Exhibit 1017 is relevant and authenticated, and is not hearsay. 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 1–20 of the '874 patent are unpatentable under 35 U.S.C. § 103(a).

V. ORDER

In consideration of the foregoing, it is hereby

ORDERED that, based on Petitioner's showing by a preponderance of the evidence, claims 1–20 are unpatentable;

FURTHER ORDERED, that Petitioner's Motion to Exclude is DENIED with respect to Exhibit 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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