

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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NEW NGC, INC., dba NATIONAL GYPSUM COMPANY,  
Petitioner

v.

UNITED STATES GYPSUM COMPANY,  
Patent Owner.

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Case No. IPR2017-01352  
U.S. Patent No. 8,142,914

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**PATENT OWNER UNITED STATES GYPSUM COMPANY'S  
PRELIMINARY RESPONSE**

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## LIST OF EXHIBITS

EXHIBIT NO.	TITLE
1001	Expert Declaration of Gerry Harlos
1002	U.S. Patent No. 6,632,550 (“the ’550 patent”)
1003	U.S. Patent No. 6,342,284 (“the ’284 patent”)
1004	Selections from the Prosecution History of the ’284 Patent
1005	Selections from the Prosecution History of the ’550 Patent
1006	U.S. Patent No. 5,932,001 (“Graux”)
1007	U.S. Patent No. 3,234,037 (“Satterthwaite”)
1008	U.S. Patent No. 5,980,628 (“Hjelmeland”)
1009	ASTM C473-95
1010	U.S. Patent No. 2,884,413 (“Kerr”)
1011	U.S. Patent No. 3,770,468 (“Knauf”)
1012	Thomas Koslowski & Udo Ludwig, The Chemistry and Technology of Gypsum, ASTM STP 861, 103 (R. A. Kuntze, ed., 1984)
1013	Lydia M. Luckevick & Richard A. Kuntze, <i>The Relationship Between Water Demand and Particle Size Distribution of Stucco</i> , in The Chemistry and Technology of Gypsum, ASTM STP 861, 84-85 (R.A. Kuntze, ed., 1984)
1014	ASTM C472-93
1015	Robert F. Acker, Physical Testing of Gypsum Board Per ASTM C 473, 3-7 (R.A. Kuntze, ed., 1984)
1016	L. Amathieu, Improvement of Mechanical Properties of Set Plasters, 79 J. of Crystal Growth 169, 176 (1986)
1017	U.S. Patent No. 2,985,219
1018	U.S. Patent No. 3,179,529
1019	U.S. Patent No. 2,090,625
1020	U.S. Patent No. 3,190,787
1021	U.S. Patent No. 2,346,999
1022	U.S. Patent No. 3,573,947
1023	U.S. Patent No. 4,009,062
1024	U.S. Patent No. 5,320,677
1025	U.S. Patent No. 5,534,059
1026	U.S. Patent No. 5,395,438
1027	U.S. Patent No. 3,246,063

EXHIBIT NO.	TITLE
1028	Redacted Complaint
1029	[reserved]
1030	[reserved]
1031	ASTM C473-81
1032	U.S. Patent No. 5,085,929
1033	[reserved]
1034	[reserved]
1035	[reserved]
1036	U.S. Patent No. 5,643,510
1037	[reserved]
1038	U.S. Patent No. 8,142,914
1039	[reserved]
2001	Declaration of Robert Bruce
2002	EP 603,727
2003	'914 File History Excerpt
2004	Transaction history for Hjelmeland

Patent Owner United States Gypsum Company (“USG”) submits this Preliminary Response to the Petition for *Inter Partes* Review (“Petition”) regarding U.S. Patent No. 8,142,914 (“’914 patent”). (Paper 2.) The ’914 patent discloses and claims novel gypsum products that include sodium trimetaphosphate (“STMP”) and other phosphate/phosphoric acid “enhancing materials” to improve resistance to permanent deformation known as “sag.”

Petitioner asserts that claims 1–4, 6, 8, and 10 of the ’914 patent are obvious under two separate grounds—Graux, ASTM C473-95, Hjelmeland, Sucech and Summerfield (Ground 1) and Satterthwaite, ASTM C473-95, Hjelmeland, Sucech and Summerfield (Ground 2). (Pet. at 2.) Petitioner falls far short of its burden to prove that *inter partes* review is warranted under either asserted ground. 37 C.F.R. § 42.108(c). The Board should exercise its discretion to deny both grounds for all challenged claims. 37 C.F.R. §42.108(b); *see* 35 U.S.C. §314(a).

## **I. Summary Of Arguments**

The Petition fails for each of the following reasons.

First, a primary, fatal defect is that the Hjelmeland reference is not prior art under 35 U.S.C. § 102(e) as Petitioner contends. Hjelmeland states on its first page: “§ 102(e) date: Mar. 6, 1998,” which is correct under controlling law. This is more than five months after the August 21, 1997 filing priority date for the ’914 patent.

Since Hjelmeland is essential to Petitioner's challenge to all claims in both grounds, the Petition should be denied in its entirety.

Second, the Petition is procedurally improper because it proposes horizontally redundant grounds without identifying how one ground improves on the other, violating Board precedent requiring identification of differences in the proposed findings of invalidity. Accordingly, the Board should exercise its discretion and deny the Petition under 35 U.S.C. § 325(d) and the redundancy principles of *Liberty Mutual Insurance Co. v. Progressive Casualty Insurance Co.*, CBM2012-00003, Paper 7 (PTAB Oct. 25, 2012).

Third, none of the asserted references address the problems solved by the invention of the '914 patent claims, or even similar problems; and none disclose or suggest anything remotely similar to the solutions recited in the claims. Petitioner fails to show that the challenged claims are obvious in view of any of the cited references, separately or combined. Petitioner's references do not disclose or suggest that STMP or any other claimed "enhancing material" should be added to a gypsum slurry in the manufacture of set gypsum boards or could increase the sag resistance of a gypsum board as required by independent claim 1. Petitioner and its expert, Mr. Harlos, present select excerpts from the references out of their full context, misrepresent their actual teachings, and fail to acknowledge other portions of the

references that demonstrate that they do not disclose (expressly or inherently) the particular claim element for which they are cited.

Indeed, their contentions are unsupported by competent data, facts and documents. The most telling example is that Petitioner relies upon starch references that disclose that starch may be crosslinked with STMP. But as explained herein, crosslinked starch is not STMP, and is irrelevant to the claimed invention.

Petitioner and Harlos fail to show that a person having ordinary skill in the art (“PHOSITA”) would have been motivated to utilize any of the cited references, let alone to combine them, to solve the problems addressed by the challenged claims. Similarly, Petitioner lacks any evidence that the challenged claims were the predictable result of any known use of the claimed enhancing materials in gypsum boards or other products. Rather, Petitioner’s references either provide no such guidance or lead away from the claimed use of STMP and other enhancing materials. Therefore, Petitioner fails to establish a reasonable likelihood that the challenged claims would have been obvious at the time of the invention from the cited references. Moreover, even if there was reason to consider the combinations alleged (there is not), the combinations still fail to account for all of the elements of the recited claims.

Thus, Petitioner cannot demonstrate a reasonable likelihood that any of the challenged claims are invalid under either asserted ground. While there are other reasons to deny the Petition, the deficiencies addressed herein are sufficient and dispositive. Therefore, USG respectfully requests that the Board reject the Petition and decline to institute trial on either asserted ground. 37 C.F.R. § 42.108(b); 35 U.S.C. § 314(a).

A supporting declaration of USG's technical expert, Dr. Robert Bruce (Ex. 2001) accompanies this Preliminary Response. It explains and corrects many of Petitioner's numerous misstatements and misrepresentations regarding the asserted references and the knowledge of a PHOSITA.

## **II. Responsive Overview Of The Relevant Technology**

Petitioner and its expert take many liberties in describing the background of the technology at issue. This Section is intended to clarify the record and to provide additional relevant background.

### **A. Gypsum And Set Gypsum**

Gypsum is the main constituent in many forms of plaster and wallboard, and has many other uses. (Ex. 2001 ¶35.) Gypsum board is produced by mixing calcined gypsum (calcium sulfate hemihydrate) with water and optional additives to form an aqueous slurry. (*Id.* ¶36.) The water reacts with the calcined gypsum to convert the

calcium sulfate hemihydrate into a crystalline form of calcium sulfate dihydrate, which is generally referred to as “set gypsum.” (*Id.*)

The slurry is then deposited between upper and lower cover sheets effectively sandwiching the gypsum slurry into a gypsum core. (*Id.* ¶37.) During this process, the gypsum slurry hardens and “sets.” The crystalline calcium sulfate dihydrate grows as needle-like crystals, which form an interlocking crystalline matrix or network to give the core and board its physical integrity. (*Id.* ¶38.)

Additives are commonly used in gypsum board to achieve certain desired board characteristics. Additives may include foam, accelerators, set retarders, recalcination inhibitors, binders, adhesives, dispersing aids, leveling agents, thickeners, bactericides, fungicides, pH adjusters, colorants, reinforcing materials, fire retardants, water repellants, fillers, etc. (*Id.* ¶¶39–41, 51–57.) The chemistry and interactions between the components within the gypsum slurry are complex, such that slurry formulations should be carefully developed and controlled. (*Id.* ¶40.)

#### **B. “Sag” In Set Gypsum Used For Gypsum Board**

A unique property of set gypsum when used to make gypsum board is that under conditions of high humidity, the gypsum board will change shape over time. (*Id.* ¶ 49.) This phenomenon is called “sag.” (*Id.*) It results from the gypsum crystals slowly and irreversibly changing shape as a result of the force of gravity in the

presence of absorbed moisture. (*Id.*) This sag behavior takes place faster under conditions of high humidity, with high salt content in the gypsum, or with lower board weights. (*Id.*; *see also* Ex. 1038 at 2:35–38.) Sag can also occur during transportation and storage and when water-containing surface treatments are applied to the boards. (Ex. 2001 ¶71.) Among other problems, sagged and warped boards are unsightly, more easily damaged, and prone to failure as they are not supported evenly on all sides and by all fasteners when they are installed in a building. (*Id.*; Ex. 1038 at 2:50–51.)

The sag phenomena of set gypsum-containing products, such as gypsum board, is different from “creep,” “slump” or “spread” used to describe the undesired movement of plaster after it has been applied to a surface and is still in a viscous state before setting. (Ex. 2001 ¶¶43–50.) The latter phenomenon is discussed in Graux and Hjelmeland. (*Id.* ¶¶46–48.) The sag that can occur in gypsum board also involves a different phenomenon from the warping or sagging of starch-based mineral wool ceiling tile products, such as discussed in Satterthwaite, which is due to uneven drying of the tile wherein the starch adhesive fails to bind the tile components together to keep their shape. (*Id.* ¶49.)



**C. Petitioner's Central Premise Is False—Crosslinking Starch Is Irrelevant To Adding STMP to Gypsum Slurries**

The foundation of Petitioner's challenge is that the primary references, Graux and Satterthwaite, each disclose using STMP as an ingredient in a set gypsum-containing product. Petitioner and Harlos, however, do not point to any example, description or claim from these references where STMP or any other claimed enhancing material is actually added to or otherwise present in the compositions used to form the products of the references.

Both Graux and Satterthwaite, in fact, concern using a variety of different starches in mixtures used to form plaster products (Graux) and mineral wool ceiling tiles (Satterthwaite). (*Id.* ¶¶100–01, 122–23.) The references mention STMP as only one of many different reagents that can crosslink their starches. (*Id.* ¶¶103, 129.) In both references, crosslinking is carried out before the starch is added to the mixtures used to make their products. (*Id.* ¶¶103, 110–11, 129–30.) Moreover, Satterthwaite teaches that its starch crosslinking is followed by washing and drying the starches, which removes all excess STMP from the crosslinked starches. (*Id.* ¶130.) Graux refers to another reference for its description of crosslinking starch, which also confirms the conventional washing and drying steps. (*Id.* ¶110.)

Petitioner's secondary references fail to remedy these deficiencies. The lack of key elements in Petitioner's references that are required in independent claim 1 is fatal to each ground.

**D. There Is No Evidence That STMP Was Used Or Was Known To Be Effective To Increase Sag Resistance In Set Gypsum-Containing Products**

Attempting to fill the glaring holes in the references, Petitioner and Harlos assert, again without any competent support, that the use of STMP to increase sag resistance in set gypsum products was well-known in the art. (*See, e.g.*, Pet. at 7; Ex. 1001 ¶¶48, 64.) They offer no evidence showing the use of STMP or any other claimed enhancing material in a set gypsum board to provide increased sag resistance or the other benefits disclosed in the patent. The state of the art at the time of the invention was quite the opposite: the common belief was that phosphates, such as STMP, were set retarders that slow the formation rate of set gypsum and decrease the set gypsum strength. (Ex. 1038 at 4:43–54; Ex. 2001 ¶67.)

As explained further below, the references upon which Petitioner relies actually show STMP and other phosphate materials used only as set retarders or starch crosslinkers. That using the claimed “enhancing materials” to increase sag resistance of set gypsum products escaped the industry, despite decades of research and development in the vast global market for set-gypsum products, strongly

suggests nonobviousness. *See Leo Pharm. Prods., Ltd. v. Rea*, 726 F.3d 1346, 1356–59 (Fed. Cir. 2013) (emphasizing time lapse as indicating nonobviousness).

### **III. Overview Of The '914 Patent And Its Prosecution History**

The '914 patent relates back to a series of prior applications, including an original application filed August 21, 1997. (Ex. 1038.) Each of the prior applications is incorporated by reference into the '914 patent specification, including the related U.S. Patent No. 6,342,284 (“’284 patent”). (*Id.* at 1:4–22.) Petitioner does not contest August 21, 1997 as the effective filing date of the '914 patent. (Pet. at 22.)

#### **A. The Patented Technology**

The patented technology relates to methods and compositions for making set gypsum products having increased resistance to sag and other improved properties. (Ex. 1038 at 1:26–52.) The specification explains that set gypsum-containing products, such as wallboard for interior walls and ceilings, could be made more resistant to encountered stresses if the strength of their component set gypsum crystal structures were increased. (*Id.* at 2:23–26.) It notes efforts in the industry to make lower density, lighter weight products, and explains that in such products “there is a need to increase the strength of the set gypsum above normal levels just to maintain overall product strength at the levels of the previously higher density product,

because there is less set gypsum mass to provide strength in the lower density product.” (*Id.* at 2:27–34.)

The specification also describes a need for gypsum products that are resistant to permanent deformation and sag over the useful life of the products, especially under conditions of high humidity and temperature. (*Id.* at 2:35–38.) Gypsum board products must also be able to carry loads, such as from insulation or condensation, without noticeable sag. (*Id.* at 2:43–56.)

Previous approaches to combating sag include using heavier (higher density) boards, thicker boards, or additives such as boric acid. (Ex. 2001 ¶ 72). Heavier or thicker boards are generally more expensive to manufacture and transport, and more difficult to handle and install. (*Id.*) Boric acid in large amounts has the detrimental effect of making gypsum boards brittle. (*Id.*)

The ’914 patent specification also describes a need for greater dimensional stability of set gypsum products during their manufacture and use. (Ex. 1038 at 2:57–59.) Absorption of moisture can cause gypsum boards to undesirably expand when exposed to high humidity. (*Id.* at 2:59–61.) Also, when unreacted water is driven off by heating set gypsum board products during the manufacturing process, conventional gypsum cores shrink as the set gypsum crystals of the matrix move

closer together as the water evaporates. (*Id.* at 2:65–3:6.) This reduces production yields during gypsum board manufacture. (*Id.* at 3:7–10.)

**B. The Claimed “Enhancing Materials”**

The ’914 patent discloses a particular group of condensed phosphoric acid and condensed phosphate compounds, denoted using the short-hand “enhancing materials.” The inventors made the surprising discovery that these materials provide remarkable sag resistance, improved strength and other improved properties when compared to known additives for set gypsum-containing products. (Ex. 1038 at 1:26–52.) The specification introduces the “enhancing materials” and their benefits generally in the Field of the Invention and then more specifically identifies the “enhancing materials”:

A set gypsum-containing product of the invention having increased resistance to permanent deformation is prepared in accordance with the invention by forming a mixture of a calcium sulfate material, water, and an appropriate amount of one or more enhancing materials chosen from: condensed phosphoric acids, each of which comprises 2 or more phosphoric acid units; and salts or ions of condensed phosphates, each of which comprises 2 or more phosphate units.

(*Id.* at 3:65–4:5.)

The specification discloses that STMP is a preferred enhancing material. (*Id.* at 4:17–24.) It reports that when trimetaphosphate ion is added to a mixture of

calcined gypsum and water, the resulting set gypsum was unexpectedly resistant to sag, stronger and more dimensionally stable than conventional set gypsum. (*Id.* at 4:27–42.) This discovery that STMP and certain other phosphate and phosphoric acid materials significantly enhanced those properties and did so without detrimentally retarding the gypsum setting rate was unexpected and highly significant in the gypsum board industry. (Ex. 2001 ¶83.)

**C. The Disclosed And Established Benefits Of The “Enhancing Materials”**

The '914 patent provides a considerable amount of data demonstrating the benefits of STMP and other representative enhancing material phosphate/phosphoric acid compounds relative to controls and other comparative samples. *See* Table 1 (showing increased compressive strength) (Ex. 1038 at 13:1–31); Table 2 (showing samples made with STMP were much more resistant to sag than samples containing only conventional sag resistance additives) (*id.* at 14:44–67); Table 3 (showing increased nail pull resistance) (*id.* at 16:44–53, 17:9–20); Table 5A (showing increased sag resistance as measured by the standard ASTM C473-95 test protocol) (*id.* at 18:58–67, 19:1–13) and Table 6 (showing improved dimensional stability, i.e., reduced the length and width shrinkage, of gypsum boards) (*id.* at 19:22–41).

**D. The Prosecution History Of The '914 Patent**

Prosecution of the '914 patent application did not involve any office action rejections involving §§ 102 or 103 prior art. Notably, Hjelmeland, one of Petitioner's applied references, is among those listed on the face of the '914 patent. (Ex. 1038; *see also* Ex. 2003.) Of course, no further consideration of that reference was necessary then (or now) because Hjelmeland is not prior art to the '914 patent.<sup>1</sup>

**E. The Claims Of The '914 Patent**

The claims of the '914 patent are product-by-process claims. Independent claim 1 includes, among other things, forming a mixture of calcined gypsum, water, an accelerator, and an “enhancing material” selected from a Markush group, and then maintaining the mixture under conditions sufficient for the calcined gypsum to form into an interlocking matrix of set gypsum. Claim 1 further recites adding enough enhancing material so that the gypsum board has increased sag resistance and that the sag resistance of the board as determined according to the ASTM C473-95 test is less than 0.1 inch per two foot length of board. Claim 1 also recites that the accelerator is included in an amount that increases the strength of the board.

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<sup>1</sup> Petitioner's allegations regarding the prosecution of two related applications are immaterial to the Petition and simply wrong, as even a cursory read of the cited exhibits shows. (*See* Pet. at 9–10; Exs. 1004, 1005.)

#### **IV. The Petition Fails To Meet The Requirements For Instituting Review**

Trial should not be instituted because the Petition does not comply with numerous Board requirements.

##### **A. Petitioner Erroneously Relies On Hjelmeland As Prior Art In Both Grounds**

Petitioner asserts that Hjelmeland is prior art under §102(e). (Pet. at 19.) It is not. Hjelmeland indicates that its § 102(e) date is March 6, 1998. (Ex. 1008.) Petitioner, however, incorrectly relies upon the May 14, 1996 PCT filing date or alternatively the December 5, 1996 publication date. (Pet. at 19.) Petitioner is not entitled to rely upon either date.

Under 35 U.S.C. § 102(e), certain international application publications can be considered prior art as of their respective U.S. filing dates and certain international filing dates. References based on international applications that were filed prior to November 29, 2000 are subject to the pre-AIPA version of § 102(e) (i.e., the version in force on November 28, 2000). That pre-AIPA statute, however, limits the effective U.S. filing date of such an international application to the date when it satisfied all of “the requirements of paragraphs (1), (2), and (4) of section 371(c)” of Title 35. Those paragraphs require payment of a fee, a copy of the application, and an oath or declaration of the inventor. The applicant did not meet these requirements until March 6, 1998. (Ex. 2004.)



Thus, the proper § 102(e) date for Hjelmeland is March 6, 1998. This is more than five months after the August 21, 1997 priority date applied by Petitioner (*see* Pet. at 22), and thus Hjelmeland cannot qualify as prior art to the '914 patent. Hjelmeland is relied upon for the challenge to independent claim 1 (as well as the challenge to dependent claim 2) in both grounds. Therefore, the Petition should be rejected in its entirety because all challenges rely upon Hjelmeland as prior art. (Pet. at 2, 15.)

**B. The Board Should Not Institute On Horizontally Redundant Grounds**

Horizontal redundancy exists when a proposed ground of invalidity applies “a plurality of prior art references . . . not in combination to complement each other but as distinct and separate alternatives.” *Liberty Mut.*, CBM2012-00003, Paper No. 7 at 3. This occurs when the references “provide essentially the same teaching to meet the same claim limitation, and the associated arguments do not explain why one reference more closely satisfies the claim limitation at issue in some respects than another reference, *and* vice versa.” *Id.* (emphasis in original).

Such redundancies place a significant burden on the Board and patent owner, causing unnecessary delay and compromising the ability to complete review within the statutory deadline. *Id.* at 2. A redundancy analysis properly focuses on whether the petitioner articulated a meaningful distinction of the relative strengths and

weaknesses of its application of the prior art to one or more claim limitations. *EMC Corp. v. PersonalWeb Techs., LLC*, IPR2013-00087, Paper 25 at 3–4 (PTAB June 5, 2013).

Here, Ground 2 is redundant of Ground 1. Ground 1 asserts that Graux in light of several secondary references renders claims 1–4, 6, 8, and 10 obvious. Ground 2 asserts that the identical claim set is rendered obvious by Satterthwaite in light of the same secondary references. Contrary to the Board’s mandate in *Liberty Mutual*, the Petition does not explain the differences between Graux and Satterthwaite, and does not identify which base reference or which obviousness theory using either base reference is better (or worse) in any respect than the other for any of the challenged claims. Indeed, Petitioner’s arguments in Ground 2 using Satterthwaite are almost mirror images of those set forth in Ground 1 using Graux. (*Compare* Pet. at 22–29 *with id.* at 44–51.)

The Board should exercise its discretion not to institute trial on the redundant ground because Petitioner’s practice prevents the just, speedy, and inexpensive resolution of these proceedings. 37 C.F.R. §§ 42.1(b), 42.108.

## **V. The Petition Advances Flawed Claim Constructions That Should Be Rejected**

A party may request a district court-type claim construction if the challenged patent will expire within 18 months from the entry of the Notice of Filing Date

Accorded to Petition. 37 C.F.R. § 42.100(b). The '914 patent will expire no later than August 21, 2017 (*see* Ex. 1038), which is within this 18 month period. USG timely filed a motion requesting a district court-type claim construction on May 25, 2017. (Paper 6.) Petitioner acknowledges that the *Phillips* district court standard applies. (Pet. at 10–11.) Therefore, the Board should apply the district court *Phillips* standard.

**A. The *Phillips* Standard**

When interpreting claims of an expired patent, the Board's analysis is similar to that of a district court. *In re Rambus, Inc.*, 694 F.3d 42, 46 (Fed. Cir. 2012); *see also Black & Decker, Inc. v. Positec USA, Inc.*, 646 F. App'x 1019, 1024 (Fed. Cir. 2016). Specifically, claim terms are given their ordinary and customary meaning, as would be understood by a PHOSITA at the time of the invention, in light of the language of the claims, the specification, and the prosecution history. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313–18 (Fed. Cir. 2005).

In *Phillips*, the Federal Circuit set forth several guideposts to follow when construing claims. The PHOSITA is deemed to read the words used in the patent documents with an understanding of their meaning in the field. 415 F.3d at 1313. The “ordinary meaning” of a claim term should be determined from how the term is used in the context of the patent specification: “Importantly, the PHOSITA is

deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification.” *Id.* at 1313.

*Phillips* clarified that the specification is “the single best guide” for determining that ordinary meaning. In other words, the specification “acts as a dictionary when it expressly defines terms used in the claims or when it defines terms by implication.” *Id.* at 1321. Thus, the manner in which the disputed term is used in the patent specification is of paramount significance. *See e.g., Medrad, Inc. v. MRI Devices Corp.*, 401 F.3d 1313, 1319 (Fed. Cir. 2005) (“We cannot look at the ordinary meaning of the term . . . in a vacuum. Rather, we must look at the ordinary meaning in the context of the written description and the prosecution history.”). “Without a customary meaning of a term within the art, the specification usually supplies the best context for deciphering claim meaning.” *Honeywell Int’l v. Universal Avionics Sys. Corp.*, 488 F.3d 982, 991 (Fed. Cir. 2007) (internal citation omitted).

## **B. Claim Construction**

### **1. “Accelerator”**

Petitioner cannot support its assertion that “a PHOSITA would understand an accelerator to mean any ‘reagent or combination of reagents known to be useful to

influence the rate of formation of set gypsum.’” (Pet. at 14 (citing Ex. 1001 ¶77).) Mr. Harlos supports Petitioner’s proposed construction with a quote from related U.S. Patent No. 6,632,550 (a continuation of the ’284 patent) (Ex. 1002 at 35:20–22): an accelerator can be “[a]ny of the materials known to be useful to accelerate the rate of formation of set gypsum.” Yet Mr. Harlos gives no reason to deviate, as he and Petitioner do, from that definition. Petitioner and Harlos further ignore the intrinsic record of the ’914 patent and its own references, both of which are consistent with that definition.

As Dr. Bruce explains, because Petitioner’s interpretation encompasses any reagent that “influences” the formation of set gypsum, it would erroneously include reagents that retard, i.e., stop or slow, gypsum set rates. (Ex. 2001 ¶94.) The plain meaning of “accelerator” in this art is a reagent that accelerates, i.e., increases the rate of gypsum crystal setting. (*Id.* ¶92.)

The related ’284 patent, which is incorporated by reference into the ’914 patent (Ex. 1038 at 1:4–22), teaches that accelerators can be prepared according to the method disclosed in U.S. Pat. No. 3,573,947 (Ex. 1003 at 12:53–58), which plainly discloses that accelerators reduce set time (Ex. 1022 at 7:16–29). The ’914 specification, moreover, distinguishes between agents that accelerate set gypsum formation and those that retard this process. (*See* Ex. 1038 at 4:43–54.)

Even the other references that Petitioner cites distinguish between additives that “influence” the rate of gypsum setting by retarding or slowing gypsum setting and those that accelerate or increase the gypsum setting rate. (*See, e.g.*, Ex. 1012 at 10; Ex. 1022 at 3:10–20.) Thus, Petitioner’s asserted interpretation of “accelerator” should be rejected.

“Accelerator” is more properly construed as “any reagent or combination of reagents effective to increase the rate of formation of set gypsum.” (Ex. 2001 ¶92.)

## **2. “Enhancing materials”**

Because the ’914 claims each recite the specific enhancing materials encompassed by the particular claim, there is no ambiguity to resolve and this term does not need to be construed for purposes of this proceeding. However, for consistency among the challenges to this family of patents, and because the term does require construction in IPR2017-01088, USG addresses this term herein for completeness.

As Dr. Bruce explains, the term “enhancing materials” does not have an ordinary and accustomed meaning in the field of set gypsum products. (Ex. 2001 ¶85.) Petitioner cannot support its construction of this term as “an additive that improves at least one of resistance to permanent deformation, strength, and dimensional stability in set gypsum-containing products.” (Pet. at 13–14.)

Petitioner and Harlos rely on the “Field of the Invention” section for their construction. (*Id.* at 13 (citing Ex. 1038 at 1:42–47).) The Field of Invention, however, does not use “enhancing materials” to refer to *all* additives that might be used to make a set gypsum product with improved deformation, strength or dimensional stability. To the contrary, the passage relied upon by Petitioner and Harlos uses the term “enhancing materials” as a shorthand description of the additives more specifically identified in the specification. It is those more specifically-described “enhancing materials” that provide the benefits mentioned in the Field of the Invention (Ex. 1038 at 1:26–52), including the preferred embodiments of the invention, (*id.* at 1:34–42), and the alternative embodiments using those “enhancing materials” (*id.* at 1:42–52).

The '284 patent, which is incorporated by reference into the '914 specification, identifies the “enhancing materials” as: phosphoric acids, each of which comprises 1 or more phosphoric acid units; salts or ions of condensed phosphates, each of which comprises 2 or more phosphate units; and monobasic salts or monovalent ions of orthophosphates. (Ex. 1003 at 4:3–9.) The additional passages appearing directly in the '914 patent describing enhancing materials are all consistent with the definition provided in the '284 patent. The '914 patent only uses “enhancing materials” to refer to compounds that are within the definition

incorporated by reference from the '284 specification. (*See e.g.*, Ex. 1038 at 3:65–4:5; 5:67–6:4, 6:14–16:19, 6:28–33; 6:39–44, 6:50–54, 6:61–62, 27:37–47.) In fact, all of the embodiments mentioned in the Field of the Invention use STMP or one of the other condensed phosphoric acid, condensed phosphate, or orthophosphate compounds defined in the specification as “enhancing materials.” (*Id.* at 1:26–52.)

There is no suggestion in the Field of the Invention or the rest of the specification that all materials that potentially may improve the deformation, strength or dimensional stability of a set gypsum material of gypsum products are “enhancing materials.” Indeed, conventional additives that might be used to improve or modify properties of gypsum wallboard are distinguished from “enhancing materials” and are used for comparative purposes. (Ex. 1038 at 14:33–64, 28:62–67, 31:30–35; Ex. 2001 ¶¶87, 89–90.) Moreover, if Petitioner was correct that “enhancing materials” includes any additive that improves deformation resistance, strength or dimensional stability, then, for example, pregelatinized starch would be considered an enhancing material. But it is never characterized as such in the specification or the claims. (*See e.g.*, claim 6, separately reciting pregelatinized starch and enhancing materials.)

When a patentee elects to define a recited claim term in the specification, that definition controls so long as it appears “with reasonable clarity, deliberateness, and



precision.” *Renishaw PLC v. Marposs Societa’ per Azioni*, 158 F.3d 1243, 1249 (Fed. Cir. 1998); *see also Lear Siegler, Inc. v. Aeroquip Corp.*, 733 F.2d 881, 889 (Fed. Cir. 1984). It is not required that the intended meaning be conveyed as an explicit definition. *In re Abbott Diabetes Care, Inc.*, 696 F.3d 1142, 1150 (Fed. Cir. 2012).

There can be no question the ’914 patent provides just such a definition of the “enhancing materials” used to make its set gypsum products. *See* Section III.B. This construction is further confirmed by the data in the examples and tables. For example, Table 2 compares the sag resistance of gypsum board containing STMP with a control board (no additive) and with other samples containing only conventional sag resistance additives, such as boric acid, sodium aluminum phosphate, wax emulsion, and glass fiber. (Ex. 1038 at 14:38–57.) The results were:

The data in TABLE 2 illustrate that the board (STMP) prepared in accordance with the invention was much more resistant to sag (and thus much more resistant to permanent deformation) than the control board and the noninventive comparative boards.

(*Id.* at 14:60–64.)

Table 13 and Table 16 also include a boric acid sample (with no other additive) for comparison purposes. The sag resistance measurements of the boric acid samples are closer to the control samples than to the inventive enhancing

material samples. Tables 14 and 15 present data showing significant sag resistance provided by polyphosphoric acid and polyphosphate materials. The specification summarizes these tables:

The results in Tables 13, 14, and 15 show that all materials tested that are within the definition of enhancing materials above, when used to treat calcined gypsum in the production of set gypsum-containing products, cause the products to exhibit significant resistance to permanent deformation compared with the controls.

(*Id.* at 28:62–67.) A similar comment appears before Table 16. (*Id.* at 31:30–35.)

Thus, although conventional additives such as boric acid may increase strength and also effect a modest increase in sag resistance, a PHOSITA would not consider them to be within the meaning of the “enhancing materials” described and claimed in the ’914 patent.<sup>2</sup>

Independent claim 1 recites “enhancing materials chosen from the group consisting of” followed by a specific list of materials that can be chosen as enhancing materials in the claim. The enumerated materials all fall within the definition of “enhancing materials” set forth in the specification.

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<sup>2</sup> The claims are written in “comprising” form allowing the use of conventional additives in addition to the specific “enhancing materials” recited in the claims.

Therefore, the proper construction of “enhancing materials” is “phosphoric acids, each of which comprises 1 or more phosphoric acid units; salts or ions of condensed phosphates, each of which comprises 2 or more phosphate units; and monobasic salts or monovalent ions of orthophosphates.” (Ex. 2001 ¶¶85–91.)

### 3. “Set gypsum”

The correct interpretation of “set gypsum” is “a crystallized gypsum structure produced from the rehydration of calcium sulfate hemihydrate into calcium sulfate dihydrate by mixing with water.” (Ex. 2001 ¶¶95–98.)

As Petitioner admits, when calcined gypsum, which is the hemihydrate form of gypsum, is mixed with water and rehydrates to form calcium sulfate dihydrate, the resulting product “is commonly known as ‘set gypsum.’” (Pet. at 5.)

This definition is consistent with the ’914 patent, which states:

Most such gypsum-containing products are prepared by forming a mixture of calcined gypsum . . . and water . . ., casting the mixture . . ., and allowing the mixture to harden to form *set (i.e., rehydrated) gypsum by reaction of the calcined gypsum with the water to form a matrix of crystalline hydrated gypsum (calcium sulfate dihydrate)*. . . .

It is the desired hydration of the calcined gypsum that enables the formation of an *interlocking matrix of set gypsum crystals*, thus imparting strength to the gypsum structure in the gypsum-containing product.

(Ex. 1038 at 2:9–22 (emphasis added).)

**VI. Petitioner Has Not Met Its Burden To Show A Reasonable Likelihood Of Success On Its Asserted Obviousness Grounds**

**A. Legal Standards**

Under 35 U.S.C. § 103, Petitioner must prove that the claimed subject matter would have been obvious to a PHOSITA at the time of the invention. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). A complete analysis requires that the Board determine (1) the scope and content of the prior art; (2) differences between the prior art and the claims; (3) the level of ordinary skill in the art; and (4) relevant objective indicia of nonobviousness. *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17 (1966). Importantly, the obviousness inquiry must be taken without any “hint of hindsight,” *Star Scientific, Inc. v. R.J. Reynolds Tobacco Co.*, 655 F.3d 1364, 1375 (Fed. Cir. 2011).

An invention “composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.” *KSR*, 550 U.S. at 418. Moreover, Petitioner is required to show, but does not, that its disparate references would have suggested to a PHOSITA that they should make the claimed invention and that they would have a reasonable expectation of success in doing so. *In re NuVasive, Inc.*, 842 F.3d 1376, 1381–82 (Fed. Cir. 2016); *Intri-Plex*

*Techs., Inc. v. Saint-Gobain Performance Plastics Rencol Ltd.*, IPR2014-00309, Paper 83 at 19 (PTAB Mar. 23, 2014).

Similarly, Petitioner must show, but does not, that a PHOSITA would have been motivated to pick out the asserted multiple references and combine them in the way the claimed invention does. *Personal Web Techs., LLC v. Apple, Inc.*, 848 F.3d 987, 993–94 (Fed. Cir. 2017); *Ariosa Diagnostics v. Verinata Health, Inc.*, IPR2013-00276, Paper 64 at 17–18 (PTAB Aug. 15, 2016).

Petitioner must support its obviousness contentions with articulated reasoning based on rational, factual; conclusory statements of obviousness will not suffice. *KSR*, 550 U.S. at 418; *In re NuVasive*, 842 F.3d at 1382–83. Similarly, any expert testimony must explain in detail how specific references could be combined, which combinations of elements would yield a predictable result, and how any specific combination would operate or read on the asserted claims. *Activevideo Networks, Inc. v. Verizon Commc'ns, Inc.*, 694 F.3d 1312, 1327 (Fed. Cir. 2012); *Ariosa*, IPR2013-00276, Paper 64 at 20.

#### **B. Level Of Ordinary Skill In The Art**

USG contends that the education level of a PHOSITA may also include the alternative of a B.S. degree in inorganic chemistry. (Ex. 2001 ¶19.) For the purposes

of this preliminary response, USG does not otherwise dispute Petitioner's level of skill in the art.

### **C. Overview Of Asserted Prior Art**

Petitioner contends that the following references discussed below are within the scope and content of the prior art relevant to the '914 patent. As demonstrated above, Hjelmeland is not prior art. Hjelmeland is discussed herein solely to provide a complete response, and, by doing so, USG does not suggest it should be considered.

#### **1. Graux**

Dr. Bruce provides a thorough summary of what Graux discloses to a PHOSITA. (Ex. 2001 ¶¶100–12.) Graux does not disclose: (i) adding STMP to a gypsum composition; (ii) any gypsum composition containing STMP; or (iii) any of the other claimed enhancing materials.

Graux discloses adding “amylaceous” starch compounds as thickening agents to a plaster, coating or adhesive composition. (Ex. 1006 at Abstract.) Graux uses “amylaceous compound” to refer to a broad range of starches of natural or hybrid origin, as well as starch mixtures and mixtures containing starch(es) and vegetable proteins. (*Id.* at 4:49–67.)

These starch compounds can be subjected to many different chemical and physical treatments to increase their solubility in water, particle size, etc. (*Id.* at 5:30–6:58.) One of the suggested chemical treatments is to chemically “crosslink” the amylaceous starches. (*Id.* at 5:34–53). Graux mentions several chemical crosslinkers, including STMP. (*Id.* at 5:46–51.) Graux’s only other mention of STMP is a passing comment that an amylaceous potato starch used in an example was crosslinked using STMP. (*Id.* at 10:28–30.)

Graux does not disclose or suggest using STMP or any of the other claimed enhancing materials in any of its plaster materials. Petitioner and Harlos each contend that Graux discloses a plaster composition containing calcined gypsum, water, starch *and* **STMP**. (Pet. at 23; Ex. 1001 ¶¶92.) However, their citations to Graux do not support those allegations.

They both rely on Graux column 10, lines 29–30, but that passage simply identifies the above-mentioned crosslinked potato starch. Indeed, Mr. Harlos acknowledges this. (Ex. 1001 ¶¶110.) That crosslinked starch composition did not include the STMP reagent, all of which was either consumed during the crosslinking reaction or removed during the subsequent washing step. Both experts agree on this. (*Id.* ¶¶49; Ex. 2001 ¶¶110–11, 139.) The disclosure of such a potato starch used as a

plaster thickening agent is not a disclosure of a plaster composition containing STMP. (*Id.*)

Graux also does not suggest that the disclosed thickened gypsum pastes could be used to make a gypsum panel or that such a panel might have improved sag resistance. (Ex. 2001 ¶116.) A person skilled in the manufacture of gypsum board would understand that any such use would require counteracting Graux’s thickening agents with excess water to achieve a slurry with an acceptable fluidity range. (*See* Ex. 1006 at 1:55–61; Ex. 2001 ¶¶106, 167.) Not only is this contrary to Graux’s disclosure, but it would add manufacturing cost, time and significantly increase the energy required to remove the excess water from the panel. (*Id.*) Graux provides no information regarding improving the strength, sag resistance or dimensional stability of set gypsum panels. (*Id.* ¶108.)

## **2. Satterthwaite**

Dr. Bruce summarizes the relevant disclosures of Satterthwaite. (Ex. 2001 ¶¶122–30.) Satterthwaite does not relate to *set* gypsum-containing products. It relates to a high viscosity “starch binder” for making “acoustical ceiling tile and other tile products.” (Ex. 1007 at 1:9–17.)



Satterthwaite discloses that ceiling tile ingredients are water, mineral wool, starch, gypsum, and other ingredients, such as boric acid and paraffin wax. (*Id.* at 3:32–41.) Satterthwaite explains:

Starch and starch products have been used for many years as adhesives to bind together the various ingredients of the tile to form a plastic mass. The resulting plastic mass is then formed into a sheet, after which it is scored, dried in an oven and processed for sale.

(*Id.* at 1:18–23.) As this passage reflects, these starch-bound products are not formed by setting a composition of calcined gypsum. They do not involve using set-gypsum as a significant structural component. To the contrary, as the mixture is dried in an oven, the water evaporates and the starch strands stick to each other through hydrogen-bonding of hydroxyl groups to create a solid structure. (Ex. 2001 ¶123.)

Thus, a PHOSITA would understand that the “gypsum” used in Satterthwaite is a mineral gypsum filler rather than a calcined gypsum hemihydrate that is allowed to set to form a crystalline gypsum dihydrate matrix. (*Id.* ¶123.) As Mr. Harlos acknowledges, gypsum was commonly used in its raw mineral form (essentially ground gypsum rock) in such starch-based tile products as a filler. (Ex. 1001 ¶169.) Satterthwaite does not characterize the gypsum as being calcined gypsum (or the equivalent term calcium sulfate hemihydrate), and contains no discussion of forming set gypsum products from the hydration of calcined gypsum.

Petitioner asserts that Satterthwaite is “directed to set gypsum-containing products” and relies on the ’914 patent, not Satterthwaite, to argue that “it was known in the art that acoustical ceiling tiles could be made using rehydrated sulfate hemihydrate, i.e., set gypsum.” (Pet. at 17, 54; Ex. 1001 ¶¶139, 169.) However, tellingly, Petitioner does not and cannot point to anything in Satterthwaite that suggests that its disclosed ceiling tiles are “set gypsum-containing” products, i.e., made with a crystalline, set-gypsum structure rather than a starch binder.

Mr. Harlos asserts that the mention of “gypsum” in Satterthwaite “*could* include calcined gypsum to form set gypsum-containing acoustical tiles.” (Ex. 1001 ¶168 (emphasis added).) But, he acknowledges that such calcined gypsum would be a binder. (*Id.* ¶169; Ex. 2001 ¶125.) This would be incompatible with Satterthwaite, which uses only starch as its binder. (*Id.*)

Satterthwaite discloses using a modified “super-thick boiling starch” as the binder in its mineral wool ceiling tile. (Ex. 1007 at 1:63–65.) Satterthwaite states that its super-thick boiling starches used as the ceiling tile binder can be made by chemically crosslinking corn starch in an aqueous alkali slurry with a number of different reagents, one of which is STMP. (*Id.* at 1:63–2:13.) Satterthwaite does not disclose or suggest introducing any of those crosslinking reagents, let alone STMP, into its ceiling tile mixture. (Ex. 2001 ¶129.)

To the contrary, Satterthwaite explains that after its starch is reacted in the alkali solution, it is removed from that solution, filtered, washed and dried, all *before* the now crosslinked starch is used in Satterthwaite's mineral wool ceiling tile mixture. (Ex. 1007 at 1:48–60, 2:18–31.) This washing and drying process would have ensured that any of the remaining STMP (which is water soluble) would have been removed from the starch. (Ex. 2001 ¶¶129–30.) Thus, Satterthwaite, like Graux, discloses STMP only as a crosslinker of starch for its starch-based products, not as an additive used in those products or in a set gypsum-containing product.

Petitioner and Harlos point to Satterthwaite's reference to increasing resistance to “warp or sag.” (*See, e.g.*, Pet. at 8, 18; Ex. 1001 ¶¶45, 141.) However, such increased resistance to warp or sag is the result of Satterthwaite's improved starch binder, not STMP (or another enhancing material). Satterthwaite explains that the thick-boiling starches conventionally used as binders in ceiling tile products absorb and retain more water than unmodified starches. (Ex. 1007 at 1:29–34.) As a result, a high percentage of the tiles do not dry completely during the first pass through the oven and are reprocessed in a second drying operation. (*Id.* at 1:38–43.) Satterthwaite addresses this problem by combining a thick-boiling starch and a polyhydric alcohol fatty acid ester. (*Id.* at 1:9–12.)

It is that starch composition that allows Satterthwaite's mineral wool ceiling tiles to dry faster resulting in less wet tile produced. (*Id.* at 1:54–60.) It is also that starch composition that gives Satterthwaite's "finished tile" increased wet strength, increased density and increased resistance to warp or sag during the tile drying process. (*Id.* at 1:60–62.) Mr. Harlos acknowledges that it is the starch complex that provides the strength benefits to the products disclosed in Satterthwaite. (Ex. 1001 ¶207 ("A person having ordinary skill in the art would understand that the increased wet strength achieved by Satterthwaite is only possible due the crosslinking of the starch with, for example, STMP.").)

Regarding sag resistance, there is no disclosure suggesting that any sag resistance observed by Satterthwaite was or could be measured using the ASTM C473-95 test, which applies only to gypsum board. Thus, Satterthwaite discloses nothing relevant to set gypsum panel sag resistance and the strength and other properties of the gypsum products addressed by the '914 patent. (*Id.* ¶129.)

### **3. ASTM C473-95**

ASTM C473-95 is an industry standard that specifies 14 methods to test various properties of gypsum board products. (Ex. 1009 § 1.2.) These tests are applicable only to gypsum board. (Ex. 2001 ¶¶47, 113.) One of the test methods is

the test for humidified deflection referred to in claim 1, i.e., how much the board warps or sags when exposed to controlled humidified conditions for 48 hours. (*Id.*)

#### **4. Hjelmeland**

Dr. Bruce explains what Hjelmeland discloses to a PHOSITA at paragraphs 114–121 of his declaration. (Ex. 2001.) Hjelmeland discloses curable gypsum-based compositions for use in casting molds and finishing walls. (Ex. 1008 at Abstract, 1:12–14.) Hjelmeland explains that such compositions typically have a “pot life,” referring to the “time to gelation,” that is about one half of the time required to obtain full strength of a set product. (*Id.* at 1:16–19.) Retarders extend pot life, but may cause the spreadable composition to run or “creep” after application to a wall because of the delay in hardening caused by the retarder. (*Id.* at 1:19–25.) Prematurely adding set accelerators to counteract the retarders in such compositions may result in problems such as premature hardening in mixer units, pump or other equipment. (*Id.* at 1:25–31.) Thus, Hjelmeland addresses the need for a curable gypsum-based composition having a long time to gelation when in a pot, but a short setting time after application (*Id.* at 1:32–36.)

Hjelmeland discloses using a set retarder that is an organic acid such as a polyphosphate. (*Id.* at 4:11–12.) Hjelmeland also discusses Grahams salt (sodium hexametaphosphate) as particularly effective at extending the hardening time. (*Id.* at

8:22–25.) The conventional knowledge was that retarders either reduce the core strength of set gypsum boards or allow more control over the timing of the setting of the gypsum to reduce damage to the gypsum crystals in the board core. (Ex. 2001 ¶121.)

Hjelmeland also uses set accelerators that form complexes with, and precipitate out its phosphate, phosphonate, polyphosphate and other retarding substances, rendering them incapable of impacting the sag resistance or other properties of the set gypsum. (*Id.*; Ex. 1008 at 4:4–10, 4:24–28, 8:11–16, 8:20–32.) The resulting pot life of the Hjelmeland retarded gypsum suspension can thus be controlled to about an hour or more, followed by addition of the accelerator whereupon the composition sets within 2–15 minutes. (*Id.* at 4:46–53.)

Nothing in Hjelmeland discloses or suggests that its disclosed retarders, such as its polyphosphate, alone or in combination with its accelerators, somehow could increase sag resistance, strength or dimensional stability of a gypsum panel or other set gypsum-containing products. (Ex. 2001 ¶¶120–21.)

## **5. Sucech**

Sucech discloses a process for producing gypsum board having large foam voids using a controlled mixture of first and second foaming agents. (Ex. 1036 at Abstract, 1:42–51.) Sucech does not disclose that the use of the claimed enhancing

materials could improve the sag resistance or strength of foamed gypsum board. (Ex. 2001 ¶131.)

## **6. Summerfield**

Summerfield discloses a method for producing gypsum wallboard having cover sheets and enhanced strength and hardness at gypsum core edges. Summerfield discloses subjecting a portion of a foamed gypsum slurry to supplemental intense mixing to break the foam, adding additional foam to replace the broken foam, and using that slurry for the edge portions of the board while the central core portion is formed of the non-broken initial foamed slurry. (*Id.* at 3:43–71.) The resulting set gypsum wallboard has essentially the same density in the central and edge core portions, but the edge portions have enhanced strength and hardness to resist damage during handling and installation. (*Id.* at 3:71–4:1.) Summerfield does not relate to improving sag resistance, strength or dimensional stability of set gypsum products through use of any of the claimed enhancing materials. (Ex. 2001 ¶133.)

### **D. Petitioner Fails To Meet Its Burden on Ground 1**

Petitioner has failed to show under *KSR* and its progeny that a PHOSITA would have been motivated to use the proposed combination of prior art references to predictably achieve the claimed invention.

**1. A PHOSITA Would Not Have Been Motivated To Use Graux Or The Secondary References With Graux**

Petitioner argues that a PHOSITA would begin with Graux because it allegedly shows using STMP as an additive to a plaster composition containing calcined gypsum, water and starch. (Pet. at 23; Ex. 1001 ¶92.) However, that premise is wrong: Graux does not disclose adding STMP to a calcined gypsum slurry. Graux only discloses adding previously crosslinked starch to a gypsum composition. There is no merit to Petitioner's assertion that Graux's disclosure of using STMP to crosslink starch, and of subsequently using that crosslinked starch in a plaster, discloses adding STMP to the plaster. (Ex. 2001 ¶139.)

Furthermore, Graux is not concerned with sag resistance or strength of set gypsum products. Thus, there would have been no reason for a PHOSITA to even consider Graux when trying to solve the sag resistance problems addressed by the claims. (Ex. 2001 ¶141.) As discussed, Graux's gypsum paste is formulated to be viscous and suited for sticking on walls.

Graux specifically notes that unlike its thickening starches, amylaceous starches with "no thickening effect" are required for making plasterboard. (Ex. 1006 at 1:46–61). This also would dissuade a PHOSITA from using the thickened Graux pastes for making gypsum boards having a minimum sag resistance as specified in the challenged claims. (Ex. 2001 ¶140.)



The ASTM C473-95 test standards are not applicable to Graux. Those standards provide tests for finished gypsum boards, not Graux's plaster products. (Ex. 1009.) Graux does not suggest that its pastes could be cast into gypsum boards that could be tested under the ASTM C473-95 standards. (Ex. 2001 ¶141.) Furthermore, the ASTM C473-95 standards do not disclose a method of making a gypsum board or any other set gypsum products. (*Id.* ¶142.) Therefore, a PHOSITA could not use the ATSM standard together with Graux to arrive at the challenged claims. (*Id.* ¶¶146–47.)

Hjelmeland is directed to a different problem than both Graux and the '914 patent: creating a curable gypsum-based composition with a long pot life and short set time using a set retarder and a set accelerator that removes the set retarder, as discussed above. Nothing in Hjelmeland would advise a PHOSITA how to improve Graux's thickened starch. (*Id.* ¶¶143–44.) Nor does Hjelmeland advise how to improve sag resistance or strength of a gypsum board as claimed in the '914 patent. (*Id.* ¶146.)

Therefore, a PHOSITA considering these three disparate references would have found them remarkably unhelpful in formulating compositions that would achieve a predictable, expected improvement in the sag resistance and other strength properties of gypsum boards. (*Id.* ¶147.)

Sucech and Summerfield relate to the use of foaming agents and paper facers in the manufacture of set gypsum products. They add little beyond what the '914 patent already describes as the state of gypsum wallboard production technology as of the August 1997 filing date. (*Id.* ¶145.) These references do not disclose or suggest the use of enhancing materials to improve characteristics of set gypsum products as described and claimed in the '914 patent. (*Id.*)

The deficiencies in Petitioner's Ground 1 are evident when comparing the references' actual disclosures to the challenged claims.

**2. The Proposed Combination of Ground 1 Does Not Disclose Or Suggest All Elements Of The Challenged Claims**

**i. Independent Claim 1**

***1a: (preamble) A gypsum board comprising***

Graux discloses gypsum plaster compositions containing thickening agents, which may be formed into “finished articles.” However, a PHOSITA would understand this to refer to manual plasters, and would not find them suitable for producing gypsum board. (Ex. 2001 ¶149.) Indeed, a PHOSITA would heed Graux's warning against using the thickened pastes in such production (Ex. 1006 at 1:43–61) in light of a PHOSITA's own understanding that excess water would be needed to counteract the addition of such a thickening agent, increasing manufacturing costs. (Ex. 2001 ¶¶107, 149.) The high pH plaster compositions of

Graux further suggest that they would be inappropriate for use in gypsum slurries for gypsum boards, which require a much more moderate pH. (*Id.* ¶150.)

***1b: a core of material sandwiched between cover sheets, wherein the core comprises an interlocking matrix of set gypsum,***

As discussed in connection with element 1a, Graux counsels against using its starch thickening agents to prepare gypsum boards. Petitioner and Harlos fail to show that Summerfield overcomes Graux's directive and the deficiency in their asserted combination. (Ex. 2001 ¶151.)

***1c: the board has been prepared by a method comprising:***

Petitioner again asserts that Graux discloses a method of producing gypsum board. As discussed in connection with element 1a, this assumption is unsupported. Because Petitioner does not rely upon any additional reference to make up for this deficiency, the challenge fails here as well.

***1d: forming or depositing a mixture between the cover sheets, wherein the mixture comprises a calcined gypsum, water, an accelerator, and one or more enhancing materials . . . , and***

Petitioner erroneously argues that this element is shown by Graux alone. However, as discussed above in Section VI.C.1, Graux does not show mixing STMP or any other claimed enhancing material with calcined gypsum. Graux's disclosure

of utilizing starches that have been previously crosslinked with STMP cannot satisfy this claim element. (Ex. 2001 ¶153.)

Because of the lack of proof of this claim element, Petitioner's challenge to this claim must fail.

***1e: maintaining the mixture under conditions sufficient for the calcined gypsum to form an interlocking matrix of set gypsum,***

Because Petitioner fails to show that its proposed combination discloses the claimed mixture of element 1d, Petitioner also fails to show that its combination discloses this claim element. (*Id.* ¶155.)

***1f: the enhancing material or materials having been included in the mixture in an amount such that the set gypsum-containing product has greater resistance to permanent deformation than it would have if the enhancing material had not been included in the mixture, said board having a sag resistance as determined according to ASTM C473-95 of less than about 0.1 inch per two foot length of said board,***

As discussed above, Graux is not concerned with improving sag resistance and does not disclose or suggest adding STMP or any other claimed enhancing material to a mixture to make a set gypsum product, let alone the amount of such an addition. (Ex. 2001 ¶¶153, 156.) Therefore, Graux does not disclose using an amount of enhancing material sufficient to achieve the claimed level of sag resistance as determined by ASTM C473-95.

Petitioner’s reliance on the unsubstantiated Harlos declaration to assert that a PHOSITA “would understand” that adding a claimed “enhancing material” to the mixture would provide better resistance to deformation than if it was not added, would find it “obvious to include the enhancing materials in the mixture in amounts that provide for increased sag resistance and would have a reasonable expectation of success in doing so,” and would understand that “STMP was known in the art as improving the quality of set gypsum-containing products” (Pet. at 34–35; Ex. 1001 ¶¶113–15) is legally insufficient to establish these asserted facts. *K/S HIMPP v. Hear-Wear Techs., LLC*, 751 F.3d 1362, 1365–67 (Fed. Cir. 2014) (conclusory arguments and expert testimony about the alleged knowledge of a PHOSITA, unsupported by any corroborating evidence, may not be used to make up for shortcomings in the prior art). The same is true of Petitioner’s argument that a PHOSITA would find it obvious to test Graux’s composition and have a “reasonable expectation of success” in meeting the claimed 0.1 inch or less of sag. (Pet. at 35.) This is pure speculation and is therefore inadequate, as core factual findings must be supported by corroborating record. *Id.*

Petitioner’s allegation that the claimed degree of sag resistance is only “measuring an inherent property of an already known composition” is without

factual support, and, of course, Petitioner cannot identify any such “known composition.” (Ex. 2001 ¶157.) This allegation can also be summarily rejected.<sup>3</sup>

Petitioner also relies upon the ’914 patent’s discussion of prior art Gold Bond boards having less than 0.1 inch sag. (Pet. at 36.) But those exemplify the problems that the challenged claims overcome. The Gold Bond products were not formulated using the claimed enhancing materials and required a substantially greater board thickness and/or gypsum core density to achieve sufficient sag resistance. (Ex. 1038 at 15:13–15, Figs. 1–3; Ex. 2001 ¶¶158–59.)<sup>4</sup>

Finally, Petitioner’s unsupported claim that USG took the litigation position that this limitation is “conditional” (Pet. at 36–37) is meritless, was recently rejected by the court, and has no relevance to this proceeding.

***1g: the accelerator having been included in an amount such that the gypsum board has greater strength than it would have if the accelerator had not been included in the mixture.***

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<sup>3</sup> Petitioner’s cited case law is also inapplicable here. The ’914 patent does not claim the measurement of an inherent property of known compositions. It claims gypsum boards formulated with novel compositions, as well as the unexpected sag resistance performance achieved through use of these compositions.

<sup>4</sup> Those products also were not tested using the recited ASTM standard, and Petitioner can only speculate that they would do so. (Ex. 2001 ¶158.)

Petitioner erroneously relies upon both Graux's and Hjelmeland's use of accelerators in their plasters as disclosing this element, asserting that a PHOSITA would understand that adding an accelerator would provide improved strength. (Pet. at 37.) But neither reference describes or suggests the use of accelerators in the claimed mixtures in order to provide set gypsum-containing products with improved strength or sag characteristics. (Ex. 2001 ¶161.) Moreover, as discussed in Section VI.C.3, the accelerator in Hjelmeland causes the precipitation and removal of the retarder that is claimed by Petitioner to constitute an enhancing material, such that both would be assumed to be removed for having any effect on gypsum crystallization. (Ex. 2001 ¶161.) Further, some accelerators do not increase strength. (*Id.* ¶¶51–53.) Therefore, the disclosures of accelerators in Graux and Hjelmeland simply fail to show this claim element.

**ii. The Challenged Dependent Claims**

Each of the challenged dependent claims relies upon independent claim 1. Since Petitioner has failed to meet its burden with respect to the independent claim, Petitioner's challenge to the dependent claims must also necessarily fail. *In re Fritch*, 972 F.2d 1260, 1266 (Fed. Cir. 1992). Petitioner also fails to meet its burden with respect to at least claims 2, 6, and 8 for the additional reasons explained below.

***Claim 2: The gypsum board of claim 1, wherein the concentration of the enhancing material in the mixture is from 0.004 to about 2.0 percent by weight, based on the weight of the calcined gypsum.***

Contrary to Mr. Harlos' speculation, a PHOSITA would not look to Hjelmeland for guidance regarding the amount of STMP to add to the Graux gypsum paste composition for several reasons. (Ex. 2001 ¶64.) First, Graux does not involve adding STMP or any claimed enhancing material to the disclosed gypsum paste or finished plaster products. It only uses STMP in a chemical reaction with starch that consumes the STMP and produces crosslinked starch compounds, which are washed and dried before being added to the paste mix. In contrast, Hjelmeland uses agents having phosphate or phosphonate acid groups, or anions of polyphosphates or polyborates, to inhibit the setting of gypsum solutions. A person interested in using STMP as a starch crosslinking agent, as in Graux, would gain no useful information from the disclosures of Hjelmeland. (*Id.* ¶143.)

If a PHOSITA did attempt to supplement the Graux paste by adding the Hjelmeland retarder, the retarder would inhibit the gypsum paste from curing, leaving it in a partially gelled state. Such a partially gelled mixture could not be formed into gypsum board that could be tested under the ASTM C473-95 standards. One of ordinary skill would have no way of predicting what the resulting properties of a set gypsum matrix made from such a mixture might be in any form. (*Id.* ¶144.)



Further, because of the different purposes of Hjelmeland's phosphate compounds and the claimed enhancing materials of the '914 patent, a PHOSITA would not be motivated to select a concentration in the range of this claim element. (*Id.* ¶¶162–63.) The amount of phosphate compound used in Hjelmeland is dictated by Hjelmeland's objective of retarding crystal growth to keep the gypsum plaster paste in a fluid form so that it can be mixed and pumped. The pot life and final set time for the application disclosed in Hjelmeland is affected by an accelerator which removes the phosphate retarder and renders it incapable of impacting the sag resistance, strength or other properties of the set gypsum. Thus, nothing about the recited phosphate compounds concentrations in Hjelmeland informs the range of enhancing materials in claim 2, and indeed, a PHOSITA would expect them to be quite different. (*Id.* ¶162.)

***Claim 6: The gypsum board of claim 1, wherein the mixture further comprises a pregelatinized starch.***

Petitioner's reliance on Graux for this claim is misplaced. (Pet. at 42.) As admitted by Petitioner, Graux discloses pregelatinized starch as a "water retaining agent," which functions as a thickening agent. (*Id.*) As discussed in Section VI.C.1, it is undesirable to add thickening agents during wallboard production because more water must be added to ensure the gypsum slurry spreads uniformly on the paper cover sheet, which in turn results in higher energy cost to drive off the excess water

in the final drying step. Thus, Graux itself teaches away from using its disclosed thickening mixture, including pregelatinized starch, for making gypsum wallboard. (Ex. 2001 ¶167.)

***Claim 8: The gypsum board of claim 1, wherein: the core has voids uniformly distributed therein; and the mixture further comprises an aqueous foam.***

Petitioner’s argument that a PHOSITA “would find it obvious to add a foaming agent as taught by Sucech to the set gypsum-containing products of Graux and would have a reasonable expectation of success in doing so” (Pet. at 43) is contrary to the teachings of Graux itself. As discussed in Section VI.C.1, Graux instructs that its starch compounds should not be added to gypsum slurries used to produce gypsum board as claimed in the ’914 patent. (Ex. 2001 ¶169.) Further, Graux teaches away from adding foam by disclosing “anti-foaming agents” instead of foaming agents. (Ex. 1006 at 7:28–59.) This is consistent with the fact that Graux is not directed to making gypsum board, including low-density foamed gypsum board. (Ex. 2001 ¶169.)

#### **E. Petitioner Fails To Meet Its Burden on Ground 2**

Petitioner similarly fails to show that a PHOSITA would have been motivated to consider, let alone use, Ground 2’s proposed combination of references to predictably achieve the claimed invention, as discussed below.

**1. A PHOSITA Would Not Have Been Motivated To Use Satterthwaite Or Combine Satterthwaite With The Secondary References**

Petitioner's Ground 2 relies on the demonstrably false contention that Satterthwaite supposedly discloses "set gypsum-containing products having enhancing materials for improving sag resistance." (Pet. at 46.) As discussed in Section VI.C.2, Satterthwaite does not disclose or suggest adding STMP, or any other claimed enhancing material, to a set gypsum-containing product. It does not even relate to set gypsum products.

Instead, like Graux, Satterthwaite concerns producing crosslinked starch. Satterthwaite's starch is used to bind water, gypsum and mineral wool into a "plastic mass" to make a ceiling tile. While Satterthwaite discloses STMP as one of many possible reagents that can crosslink that starch, Satterthwaite also leaves no question that any unreacted STMP is washed out of the crosslinked starch before it is used to make mineral wool ceiling tiles. *See supra* at Section VI.C.2. Thus, there is no merit to Petitioner's assertion that using STMP to crosslink a starch is the same as actually putting STMP into Satterthwaite's mixture, or, for that matter, a set gypsum composition.

Satterthwaite, like Graux, also is not concerned with sag resistance or the strength of set gypsum products. Instead, as explained in Section VI.C.2,

Satterthwaite is concerned with creating an improved starch binder that is quicker to make and less expensive to use in ceiling tiles than other known thick-boiling starches. Satterthwaite simply does not address or disclose using set gypsum to provide a functional benefit to such mineral wool tiles. Thus, a PHOSITA had no reason to look to Satterthwaite to solve the problems addressed by the '914 patent claims. (Ex. 2001 ¶¶176–77.)

ASTM C473-95 fails to remedy Satterthwaite's deficiencies. The details of the ASTM tests for finished gypsum board have no application to Satterthwaite's mineral wool ceiling tiles. (*Id.* ¶182.) Therefore, a PHOSITA would not be motivated to consider using the ATSM standard together with Satterthwaite for any reason. (*Id.* ¶¶184–85.)

Hjelmeland relates to a different problem than both Satterthwaite and the '914 patent: creating a curable gypsum-based composition with a long pot life and short set time through use of a combination of a set retarder and a set accelerator (that precipitates out the retarder, rendering it incapable of impacting the set gypsum properties). Hjelmeland would not have suggested to a PHOSITA that such a system could be used with Satterthwaite's crosslinked starch and mineral wool ceiling tiles. (Ex. 2001 ¶180.) Nor does Hjelmeland advise how to improve sag resistance or strength of gypsum board as claimed in the '914 patent. (*Id.* ¶¶179–80.)

Sucech and Summerfield relate to the use of foaming agents and paper facers in the manufacture of set gypsum products, but do not in any way suggest using any of the enhancing materials of the '914 patent to improve the sag resistance, strength or dimensional stability of gypsum boards. (*Id.* ¶183.) They add little beyond what the '914 patent already describes as the state of gypsum wallboard production technology as of the August 1997 filing date. These references also do not disclose or suggest the use of enhancing materials to improve characteristics of set gypsum products as described and claimed in the '914 patent. (*Id.*)

Even as combined by Petitioner (despite any evidence of a motivation to do so), these references do not disclose or suggest all elements of the challenged claims of the '914 patent, as discussed below.

**2. The Proposed Combination Does Not Disclose All Elements Of The Challenged Claims**

**i. Independent Claim 1**

***1a: (preamble) A gypsum board comprising***

Satterthwaite discloses mineral wool tile products bound with starch, not a gypsum board formed of set gypsum. (Ex. 2001 ¶187.)

***1b: a core of material sandwiched between cover sheets, wherein the core comprises an interlocking matrix of set gypsum,***

As discussed above in Section VI.C.2, the mineral wool tile products disclosed in Satterthwaite are bound with its thick-boiling starch compositions. The tiles are not set gypsum board products, and there is no disclosure of an interlocking matrix of set gypsum anywhere in Satterthwaite. (Ex. 2001 ¶¶188–89.) Petitioner’s reliance on the unsupported declaration of Harlos to assert otherwise cannot overcome the explicit disclosures of the references.

Petitioner relies on the unfounded opinion of Mr. Harlos to argue that “a PHOSITA would be motivated to combine the teachings of Summerfield [of cover sheets] with Satterthwaite.” (Pet. at 52.) However, neither Petitioner nor Harlos explains what would have supposedly motivated a PHOSITA to add Summerfield’s cover sheets to Satterthwaite’s tile products. (Ex. 2001 ¶190.) Neither reference discloses or suggests any benefit associated with the inclusion of cover sheets in starch-bound tile products, and neither reference provides any information from which a PHOSITA could have reasonably concluded that Satterthwaite’s tiles could be modified to add cover sheets without detrimentally affecting their drying characteristics. (*Id.*)

To the contrary, Satterthwaite is concerned with producing tiles that dry faster resulting in less wet tile produced. (Ex. 1007 at 1:54–60.) Satterthwaite addresses this problem by combining a thick boiling starch and a polyhydric alcohol fatty acid

ester. (*Id.* at 1:9–12.) A PHOSITA would have understood that modifying Satterthwaite’s tile products to include cover sheets would slow down the drying process and cause problems with uneven drying and warping. (Ex. 2001 ¶¶191–92.) Cover sheets would undermine the goal of improved drying that Satterthwaite attempts to achieve by use of the disclosed thick boiling starch binder. (*Id.*) Adding cover sheets would also require completely different equipment and a different process than would be used by Satterthwaite, which would ultimately slow down drying times. The longer drying times compared to set gypsum board manufacturing would make the Satterthwaite process impractical for making starch-based tiles with a core sandwiched between cover sheets. (*Id.* ¶192.)

***1c: the board has been prepared by a method comprising:***

Petitioner again asserts that Satterthwaite discloses a method of producing gypsum board. As discussed in connection with element 1a, this assumption is unsupported. Because Petitioner does not rely upon any additional reference to make up for this failure, the challenge fails here as well.

***1d: forming a mixture between the cover sheets, wherein the mixture comprises a calcined gypsum, water, an accelerator, and one or more enhancing materials . . . , and***

As discussed above in Section VI.C.2, Satterthwaite fails to disclose use of calcined gypsum or a mixture of calcined gypsum with STMP or any other claimed

enhancing material. (Ex. 2001 ¶¶195, 198.) Satterthwaite's crosslinked starch compounds mixed with water and inert gypsum filler do not contain STMP and do not meet this claim limitation. (*Id.*)

Petitioner contends that Satterthwaite's reference to "gypsum" may refer to any form of gypsum, including calcined gypsum. (Pet. at 53.) Petitioner does not and cannot point to any disclosure in Satterthwaite to support that contention. Mr. Harlos even appears to admit that Satterthwaite instead discloses a mixture with starch binder and an inert gypsum filler. (Ex. 2001 ¶195.)

Petitioner's additional argument that it would be a "very small step" to replace the starch binder with set gypsum or use set gypsum as a co-binder along with starch relies entirely on the speculation of Mr. Harlos. (Pet. at 54.) But Mr. Harlos offers no evidence that the result of such radical modifications of Satterthwaite was known or would produce predictable results, or could even produce successful mineral wool ceiling tiles. (Ex. 2001 ¶196.)

Petitioner and Harlos cannot rely on their hindsight citation to the '914 patent to show that Satterthwaite could be modified to use set gypsum as its binder. (Pet. at 54.) While the '914 patent mentions the use of rehydrated calcium sulfate hemihydrate in acoustical ceiling tile, it does not provide data or other evidence suggesting that the suggested changes to Satterthwaite would be successful. The



bottom line is that Satterthwaite fails to disclose the use of calcined gypsum in its mineral wool ceiling tiles, and Petitioner admits it.

Satterthwaite also fails to disclose an accelerator, which is not surprising given that accelerators are not applicable to the starch solidification and drying phenomenon addressed in Satterthwaite. (Ex. 2001 ¶197.) Harlos asserts a PHOSITA would be motivated to add Hjelmeland's accelerator to Satterthwaite's composition, but this flawed logic ignores that, unlike Hjelmeland, Satterthwaite is not directed to production of set gypsum products. Because of this difference, a PHOSITA would be disinclined to add an accelerator. (*Id.*)

Petitioner's assertion that Hjelmeland discloses STMP as an enhancing material is also unfounded. (Pet. at 55.) As discussed above, the alleged enhancing material in Hjelmeland is a set retarder that is precipitated and removed from the mixture when the accelerator is added, rendering it incapable of impacting the properties of the set gypsum.

***1e: maintaining the mixture under conditions sufficient for the calcined gypsum to form an interlocking matrix of set gypsum***

Because Petitioner fails to show that its proposed combination discloses the claimed mixture of element 1d, Petitioner also fails to show that its combination discloses this claim element. (*See also* Ex. 2001 ¶199.)

***If: the enhancing material or materials having been included in the mixture in an amount such that the gypsum board has greater sag resistance than it would have if the enhancing material had not been included in the mixture, said board having a sag resistance as determined according to ASTM C473-95 of less than about 0.1 inch per two foot length of said board,***

Contrary to Petitioner's argument, Satterthwaite does not disclose or suggest any amount of STMP or other claimed enhancing material to be mixed with gypsum, and therefore does not disclose using an amount of enhancing material to achieve the claimed sag resistance. *See* Sections VI.C.2 and VI.E.1. Satterthwaite's use of STMP as a crosslinking agent is irrelevant to adding STMP to a gypsum slurry to improve sag resistance of a gypsum board as required by this claim. (Ex. 2001 ¶200.)

Petitioner's assertion that Satterthwaite discloses that its "finished tile shows . . . increased resistance to warp or sag" takes the statement out of context and misses the mark. (Pet. at 55 (quoting Ex. 1007).) As discussed in Section VI.C.2, Satterthwaite is referring to increased resistance to warp or sag of "wet tile" during the drying process to reduce the production of "sub-standard tile which requires reprocessing." (Ex. 2001 ¶201.) This reference in Satterthwaite does not refer to the sag resistance of a finished gypsum board.

Petitioner's argument that a PHOSITA "would understand" that adding an enhancing material to the Satterthwaite mixture would provide better sag resistance

than if it was not added, and that a PHOSITA would find it “obvious to include the enhancing materials in the mixture in amounts that provide for increased sag resistance” is unsupported. (Pet. at 57; Ex. 1001 ¶¶175–76.) Petitioner essentially asks the Board to merely assume that this claim element was within the knowledge of a PHOSITA despite the failure of Petitioner and its expert to provide any corroborating evidence. This is improper. *K/S HIMPP*, 751 F.3d at 1365–1367.

Petitioner argues that a PHOSITA would find it obvious to use ASTM C473-95 to “test the sag resistance of the tile products of Satterthwaite and would have a reasonable expectation of success in doing so.” (Pet. at 57.) But Petitioner offers nothing more than pure speculation that a PHOSITA would have reasonable success in satisfying the claimed parameter of “sag resistance, as determined according to ASTM C473-93, of less than about 0.1 inch per two foot length.” This, too, is improper. *K/S HIMPP*, 751 F.3d at 1365–1367.

Petitioner’s allegation that the claimed degree of sag resistance is only “measuring an inherent property of an already-known composition” (Pet. at 57) is similarly without factual support, and, of course, Petitioner cannot identify any such

“known composition.” (Ex. 2001 ¶202.) This allegation can also be summarily rejected.<sup>5</sup>

Petitioner again relies on the ‘914 patent’s discussion of prior art Gold Bond products having less than 0.1 inch sag. As discussed, the Gold Bond products exemplify the problems that the challenged claims overcome. The Gold Bond products were not formulated using STMP and required a substantially greater board thickness and/or gypsum core density to achieve sufficient sag resistance. (*Id.* ¶203.)

Finally, Petitioner’s unsupported claim that USG took the litigation position that this limitation is “conditional” and that it is “lacking substantive meaning” is meritless, was recently rejected by the court, and irrelevant to this proceeding.

***Ig: the accelerator having been included in an amount such that the gypsum board has greater strength than it would have if the accelerator had not been included in the mixture.***

Petitioner, relying on the unsupported opinion of Mr. Harlos, initially asserts that a PHOSITA “would understand that adding an accelerator to the mixture would

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<sup>5</sup> Petitioner’s cited case law is also inapplicable here. The ‘914 patent does not claim the measurement of an inherent property of known compositions. It claims gypsum boards formulated with novel compositions, as well as the unexpected sag resistance performance achieved through use of these compositions.

provide improved strength to gypsum-containing products” and that a PHOSITA “would find it obvious to include the accelerator in the mixture in an amount that provides for increased strength.” (Pet. at 59 (citing Ex. 1001 ¶ 180).) As discussed above, such unsupported opinions are inadequate to establish obviousness of the claimed element.

Petitioner misses the mark in citing Hjelmeland for teaching that accelerators “accelerate the hardening process.” (Pet. at 59.) Nothing about this shows that accelerating the hardening process increases strength. Accelerators do not necessarily increase strength, they may actually reduce strength. (Ex. 2001 ¶¶51–53.)

Petitioner suggests combining Hjelmeland’s alleged disclosed accelerator with Satterthwaite’s alleged “set gypsum-containing tile products.” (Pet. at 59–60.) However, as discussed above, there would have been no motivation to add an accelerator for set gypsum to a starch mixture that lacks calcined gypsum and is not being formed into a set gypsum product. (Ex. 2001 ¶204.)

**ii. The Challenged Dependent Claims**

Each of the challenged dependent claims relies upon independent claim 1. Since Petitioner has failed to meet its burden with respect to the independent claim, Petitioner's challenge to the dependent claims must also necessarily fail. *In re Fritch*, 972 F.2d at 1266. Petitioner also fails to meet its burden with respect to at least claims 2, 6, and 8 for the additional reasons explained below.

***Claim 2: The gypsum board of claim 1, wherein the concentration of the enhancing material in the mixture is from 0.004 to about 2.0 percent by weight, based on the weight of the calcined gypsum.***

In asserting the obviousness of the claimed concentration range by referring to Hjelmeland, Petitioner ignores the difference between the purpose of using phosphate compounds in Hjelmeland and the purpose of using the claimed enhancing materials in the '914 patent. Hjelmeland's phosphate compounds retard crystal growth to keep the gypsum plaster paste in a fluid form so that it can be mixed and pumped. Enhancing materials are added to increase sag resistance, strength, and dimensional stability of gypsum boards in the '914 patent. The pot life and final set time in Hjelmeland is affected by an accelerator which removes the phosphate retarder that Petitioner asserts to be an enhancing material. Therefore, the set time in Hjelmeland would be much different than the mixing and setting times for the gypsum board claimed in the '914 patent. Moreover, Hjelmeland does not disclose

an amount of polyphosphate set retarder included in a finished product, but instead describes using an accelerator to complex with and precipitate out the retarder and prevent it from having any effect on the hydration reaction between the water and calcined gypsum. (Ex. 1008 at 4:4–10, 4:17–28.) Thus, nothing about the recited phosphate compound concentrations in Hjelmeland informs the range of enhancing material in this claim element, and indeed, a PHOSITA would expect them to be quite different. (Ex. 2001 ¶¶205–06.)

Further, Petitioner provides no explanation as to how or why a PHOSITA would or could combine Hjelmeland with Satterthwaite in the first place. Hjelmeland does not teach the use of phosphate compounds to improve sag resistance of set gypsum board, and the reference as a whole discloses subsequently reacting the retarding agent with an accelerator to neutralize the retarder and remove it from the solution. This would lead a PHOSITA to either not use or to remove any phosphate compounds from the gypsum slurry, and would not lead a PHOSITA to the claimed concentration of enhancing materials of this element. (*Id.* ¶207.)

***Claim 6: The gypsum board of claim 1, wherein the mixture further comprises a pregelatinized starch.***

Petitioner argues erroneously that “Satterthwaite contemplates pregelatinized starch as it discloses . . . gelatinization of starch and crosslinking of starch.” (Pet. at 64.) However, in the process disclosed in Satterthwaite, the disclosed composition

“is made by first treating a starch in a manner which is described hereinafter in an aqueous system at a temperature *below* its gelatinization temperature.” (Ex. 1007 at 1:48–51 (emphasis added).) The example described in the specification includes treatment of the starch at 60°F. (*Id.* at 2:19–21.) Thereafter, the “starch composition . . . becomes a binder upon gelatinization of said starch.” (*Id.* at 4:29–30, 4:35–36, 4:41–42.) The example described in the specification includes final heating of the mixture of starch and gypsum to 200° F. (*Id.* at 3:38.) Thus, Satterthwaite does not disclose, and in fact teaches away from, *pregelatinization* of the starch. (Ex. 2001 ¶210.)

Petitioner adds the unsupported Harlos opinion that the pregelatinized starch was a “known alternative.” (Pet. at 64 (citing Ex. 1001 ¶192).) However, conclusory arguments and expert testimony about the alleged knowledge of a PHOSITA, unsupported by any corroborating evidence, may not be used to make up for shortcomings in the prior art. *K/S HIMPP*, 751 F.3d at 1365–1367. Because of the lack of proof of this claim element, Petitioner’s challenge to this claim must fail for this additional reason. (*See also* Ex. 2001 ¶211.)



***Claim 8: The gypsum board of claim 1, wherein: the core has voids uniformly distributed therein; and the mixture further comprises an aqueous foam.***

Petitioner argues a PHOSITA would find it obvious to add Sucech’s foaming agent to the alleged set gypsum-containing products of Satterthwaite. (Pet. at 65.) As discussed in Section VI.C.2, Satterthwaite does not disclose a set gypsum-containing product. Instead, the acoustical ceiling tiles disclosed in Satterthwaite are bound with starch, not set gypsum. (Ex. 2001 ¶¶212–13.) Nothing in either Satterthwaite or Sucech contains any disclosure, need or motivation to use the foam disclosed in Sucech with the starch-bound acoustical ceiling tiles disclosed in Satterthwaite. Indeed, Petitioner and Harlos’ proposed combination assumes without support that Satterthwaite addresses set gypsum tile products. Because it does not, and because Sucech relates only to the use of foam to create air voids in set gypsum products, their proposed combination fails. (*Id.* ¶213.)

## **VII. Secondary Considerations**

Petitioner makes short shrift of the required issue of secondary considerations. (Pet. at 66–67). Dr. Bruce, however, explains that claimed methods were truly surprising—STMP and the other “enhancing materials” which were considered retarders with a negative effect on gypsum crystal formation could be used to give unexpected sag resistance and other properties to set gypsum products. (Ex. 2001

¶¶76, 82). The data discussed in the '914 patent, in fact, demonstrates the unexpected and superior performance of the claimed enhancing materials when compared to previous solutions to the issues of sag resistance and core strength (including Petitioner's much heavier and less effective board).

That Petitioner is compelled to use unrelated starch and set retarder references to challenge the claims further confirms that the invention was unexpected and solved a long-felt need. USG reserves the right to introduce additional evidence of the secondary considerations confirming the nonobviousness of the challenged claims should it be determined that a trial is necessary.

### **VIII. Conclusion**

For at least the foregoing reasons, the Board should deny trial on both of Petitioner's grounds.

Date: August 18, 2017

By: /Timothy P. Maloney/  
Timothy P. Maloney  
Reg. No. 38,233  
tpmalo@fitcheven.com  
Karl R. Fink  
Reg. No. 34,161  
krfink@fitcheven.com

120 South LaSalle Street  
Suite 1600  
Chicago, Illinois 60603  
(312) 577-7000  
(312) 577-7007 (fax)

**CERTIFICATE OF WORD COUNT**

The undersigned certifies in accordance with 37 C.F.R. § 42.24 that this Preliminary Response contains 13,823 words, excluding the table of contents, table of authorities, mandatory notices under § 42.8, the certificate of service, exhibit list, and this certification of word count.

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Reg. No. 38,233  
tpmalo@fitcheven.com  
Karl R. Fink  
Reg. No. 34,161  
krfink@fitcheven.com

120 South LaSalle Street  
Suite 1600  
Chicago, Illinois 60603  
(312) 577-7000  
(312) 577-7007 (fax)

**CERTIFICATE OF SERVICE**

Pursuant to 37 C.F.R. § 42.6(e), the undersigned certifies service of the foregoing **PATENT OWNER UNITED STATES GYPSUM COMPANY'S PRELIMINARY RESPONSE** on counsel of record for Petitioner by filing this document through the PTAB E2E System as well as by delivering a copy via email to the following addresses:

ross.barton@alston.com,  
ben.pleune@alston.com,  
lauren.burrow@alston.com,  
stephen.lareau@alston.com,  
adam.doane@alston.com

Date: August 18, 2017

By: /Timothy P. Maloney/  
Timothy P. Maloney  
Reg. No. 38,233  
tpmalo@fitcheven.com  
Karl R. Fink  
Reg. No. 34,161  
krfink@fitcheven.com

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(312) 577-7007 (fax)