UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AMERICAN FUJI SEAL, INC.,

Petitioner,

v.

BROOK + WHITTLE LTD.,

Patent Owner.

Case No.: IPR2025-01176

U.S. Patent No. 11,961,422

PETITION FOR INTER PARTES REVIEW OF U.S. PATENT NO. 11,961,422

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PETITIONER'S EXHIBIT LIST

NO.	DESCRIPTION	REFERRED TO AS
1001	U.S. Patent No. 11,961,422	'422 Patent or Challenged Patent
1002	File History for '422 Patent (Part I)	'422 Patent File History
1003	File History for '422 Patent (Part II)	'422 Patent File History
1004	Declaration of Dr. Robson F. Storey, Ph.D.	Storey Decl. or EX-1004
1005	CV of Dr. Robson F. Storey, Ph.D.	Storey CV or EX-1005
1006	US 11,358,363 B2	Schurr or EX-1006
1007	JP 2017-114041 A	Kitano or EX-1007
1008	JP 2004-250040 A	Ohta or EX-1008
1009	U.S. Pat. Pub. No. 2016/0361939	Keulders or EX-1009
1010	U.S. Pat. Pub. No. 2022/0389214	Lee or EX-1010
1011	Tamma, Paola; Scha100art, Eline; Gurzu, Anca (11 December 2019). "Europe's Green Deal plan unveiled". *POLITICO*.	Tamma or EX-1011
1012	Schyns, Zoé OG, and Michael P. Shaver. "Mechanical recycling of packaging plastics: a review." Macromolecular rapid communications 42.3 (2021): 2000415.	Schyns or EX-1012
1013	Ügdüler, Sibel, et al. "Towards closed-loop recycling of multilayer and coloured PET plastic waste by alkaline hydrolysis." Green chemistry 22.16 (2020): 5376-5394	Ügdüler or EX-1013

NO.	DESCRIPTION	REFERRED TO AS
1014	Limbo, Sara, et al. "Storage of pasteurized milk in clear PET bottles combined with light exposure on a retail display case: A possible strategy to define the shelf life and support a recyclable packaging." *Food chemistry* 329 (2020): 127116.	Limbo or EX-1014
1015	JP 2017-114041A	Japanese Version Kitano
1016	JP 2004-250040 A	Japanese Version Ohta

TABLE OF LIMITATIONS FOR CHALLENGED CLAIMS

LIMITATION	RECITED LANGUAGE
[1-PRE]	A recyclable shrink label comprising:
[1-1]	a heat shrink film comprising polyethylene terephthalate (PET) and having a first surface and a second surface opposite of the first surface,
[1-2]	the heat shrink film having a thickness from 15µm to 100µm; and
[1-3]	a light blocking layer disposed adjacent the first surface and comprising a light blocking component,
[1-4]	the light blocking layer being constructed for the recyclable shrink label to block at least 80% of incident light having wavelengths in a range of 200nm to 900nm,
[1-5]	wherein the light blocking component comprises a particulate having a particle size of 0.1µm to 100µm,
[1-6]	wherein the particulate comprises metal, metal oxide, a reflective pigment, carbon black, mica, or a combination thereof, and
[1-7]	wherein the recyclable shrink label is recyclable with a PET container.
[2]	The recyclable shrink label of claim 1 further comprising an indicia layer.
[3]	The recyclable shrink label of claim 1 further comprising a high opacity layer comprising a white pigment.

LIMITATION	RECITED LANGUAGE
[4]	The recyclable shrink label of claim 3, wherein the recyclable shrink label comprises an indicia layer and wherein the high opacity layer is disposed between the indicia layer and the light blocking layer.
[5]	The recyclable shrink label of claim 1, wherein the heat shrink film consists of polyethylene terephthalate (PET).
[6]	The recyclable shrink label according to claim 1, wherein the recyclable shrink label is in a form of a sleeve or tube.
[7]	The recyclable shrink label according to claim 6, wherein the heat shrink film comprises a seam.
[8]	The recyclable shrink label according to claim 1, wherein when heated to 100°C., the heat shrink film contracts or shrinks by about 1% to about 90%.
[9]	The recyclable shrink label according to claim 1, wherein when heated to 100°C, the entire recyclable shrink label contracts or shrinks by about 1% to about 90%.
[10]	The recyclable shrink label according to claim 3, wherein the high opacity layer comprises a pigment selected from titanium dioxide (TiO_2), precipitated calcium carbonate (PCC), aluminum silicate, aluminum oxide (alumina), mica-based pigments coated with thin layer(s) of white pigment, or a combination thereof.
[11]	The recyclable shrink label according to claim 1, wherein the light blocking component comprises zinc, aluminum, copper, silver, or an alloy thereof, titanium dioxide, carbon black, mica, a reflective pigment, a polymer capable of blocking light, a mineral capable of blocking light, or a combination thereof.

LIMITATION	RECITED LANGUAGE
[12]	The recyclable shrink label according to claim 1, wherein the light blocking layer is present in an amount of 0.5 ppr to 25 ppr relative to the recyclable shrink label.
[13]	The recyclable shrink label according to claim 1, wherein the light blocking layer comprises from 0.1 ppr to 10 ppr of the light blocking component.
[14-PRE]	An article comprising:
[14-1]	a container comprising polyethylene terephthalate (PET) and defining an external surface; and
[14-2]	the recyclable shrink label of claim 1 disposed on the container.
[15]	The article according to claim 14, wherein the first surface of the heat shrink film faces the external surface of the container.
[16]	The recyclable shrink label according to claim 2, wherein the indicia layer is disposed on the first surface.
[17]	The recyclable shrink label according to claim 8, wherein the heat shrink film contracts or shrinks by about 1% to 90% in a transverse direction.
[18]	The recyclable shrink label according to claim 1, wherein the heat shrink film comprises crystallizable polyethylene terephthalate (PET).
[19-PRE]	A recyclable shrink label comprising:
[19-1]	a heat shrink film comprising polyethylene terephthalate (PET) and having a first surface and a second surface opposite of the first surface,
[19-2]	the heat shrink film having a thickness from 15µm to 100µm;

LIMITATION	RECITED LANGUAGE
[19-3]	a light blocking layer disposed adjacent the first surface and comprising a light blocking component,
[19-4]	the light blocking layer being constructed for the recyclable shrink label to block at least 80% of incident light having wavelengths in a range of 200nm to 900nm, and
[19-5]	a high opacity layer comprising a white pigment,
[19-6]	wherein the recyclable shrink label is recyclable with a PET container.

I. INTRODUCTION

American Fuji Seal, Inc. ("Petitioner") requests inter partes review and cancellation of claims 1-19 ("Challenged Claims") of U.S. Patent No. 11,961,422 ("the '422 Patent"), assigned to Brook + Whittle Ltd ("PO"). This petition includes grounds for unpatentability of the Challenged Claims based entirely on prior art references that were neither available to the Examiner during prosecution nor similar to those that were. These references and the expert declaration of Dr. Robson F. Storey, Ph.D. present a compelling case that the Challenged Claims are unpatentable. Petitioner requests that the Board institute IPR and ultimately find the Challenged Claims unpatentable at least for the reasons set forth below.

II. MANDATORY NOTICES

A. <u>Real Parties-in-Interest</u>: The real parties-in-interest for this petition are Petitioner, Fuji Seal International ("FSI"), and Nestlé USA, Inc. ("NUSA").

B. <u>Related Matters</u>: To the best of Petitioner's knowledge, the '422 Patent is at issue in the following ongoing matters that could affect or be affected by this proceeding: *Brook + Whittle Ltd v. Nestlé USA, Inc., et al.,* Case No. 24-cv-735 (E.D. Tex.) ("Texas Case");[1] *American Fuji Seal, Inc. v. Brook + Whittle Ltd*, Case No. 24-

[1] PO sued FSI and NUSA in the Texas Case, alleging that they infringe each claim of the '422 Patent.

cv-1215 (D. Del.) ("Delaware Case");[2] and *Multi-Color Corp. v. Brook + Whittle Ltd*, Case No. PGR2025-00025 (PTAB) ("Multi-Color PGR").[3]

C. <u>Lead and Back-up Counsel</u>: Petitioner designates the following counsel as its representatives for this proceeding and has filed a power of attorney herewith to that effect. (Paper 2).

LEAD COUNSEL	BACK-UP COUNSEL
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[2] Petitioner sued PO in the Delaware Case, seeking a declaratory judgment that Petitioner does not infringe the '422 Patent.

[3] To Petitioner's knowledge, PO has not sued Multi-Color Corporation for patent infringement in federal court to date.

D. **Service Information:** Petitioner consents to electronic service by electronic mail of all documents and correspondence related to this proceeding. Any information related to this proceeding should be sent to Petitioner's lead and back-up counsel using the contact information above.

E. **Fee Payment:** Petitioner authorizes the Office to charge the filing fee for this petition and any other necessary fees that may be due in connection with this petition to Deposit Account No. 02-2226.

III. REQUIREMENTS UNDER 37 C.F.R. § 42.104

A. **Grounds for Standing:** The '422 Patent is available for IPR and Petitioner is not barred or estopped from requesting IPR.

B. **Identification of Challenges and Relief Requested:** Petitioner seeks cancellation of the Challenged Claims based on the following grounds:

GROUND	CLAIMS	BASIS	PRIOR ART
1	Claims 1-19	§ 103	Schurr + POSITA
2	Claims 1-19	§ 103	Kitano + Lee + POSITA

C. **Claim Construction:** The Board need not construe any term or phrase recited in the Challenged Claims to grant this petition. Claim terms are given their plain and ordinary meaning as understood by a POSITA in the context of the entire patent, including the specification and prosecution history. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-13 (Fed. Cir. 2005) (en banc). Petitioner's use of any construction is not a concession as to the proper scope of any term in litigation nor a waiver of any argument that claim terms are indefinite or otherwise invalid. Petitioner reserves the right to respond to any of PO's constructions or propose further constructions if necessary.

As explained by Dr. Storey (EX-1004, ¶ 56), a POSITA would have certain understandings of specific terms and phrases of the Challenged Claims. Specifically:

- "***Adjacent***": With respect to the term "adjacent" as used in independent claims 1 and 19 (e.g., "a light blocking layer disposed adjacent the first surface"), a POSITA would understand this term as defined in the '422 Patent specification: "The term 'adjacent' is used here to indicate which the side of the label the layer is closest. Additional optional layers may be disposed between adjacent layers." (EX-1001, 6:51-54; EX-1004 ¶ 57).

- "***Ppr***": With respect to the term "ppr" as used in dependent claims 12 and 13, a POSITA would understand this term as defined in the '422 Patent specification: "As used herein, the term 'ppr' refers to pounds per ream and is used as the unit of measurement of dry pounds of ink or coating per area of substrate (e.g., film or label). One ream is understood to mean 3000 sq ft (about 289 m^2)." (EX-1001, 5:44-47; EX-1004 ¶ 58).

- ***The recyclable shrink label is recyclable with a PET container***: This phrase, as used in claims 1 and 19, describes an intended use of the label and should not be given separate patentable weight. However, to the extent this feature is given patentable weight, a POSITA would understand it to mean that the label is ***capable of entering a PET recycling stream simultaneously with a PET container and can undergo the recycling process alongside the container***. (EX-1004, ¶ 59). This process would typically involve steps such as grinding, washing (often a caustic wash), and separation. (EX-1004, ¶ 59). The ultimate aim is producing a PET product or PET constituent materials (such as ethylene glycol and terephthalic acid) where the label components either ***separate cleanly, do not unduly contaminate the recycled PET, or are otherwise managed in a way that is considered acceptable within standard PET recycling practices***, consistent with the goal of ensuring the label does not hinder the recyclability of the PET container with which it is associated. (EX-1004 ¶ 59).

IV. SUMMARY OF THE '422 PATENT

Effective Filing Date and Applicable Law: The '422 Patent issued on April 16, 2024, from Application Serial No. 18/103,234, filed January 30, 2023. (EX-1001, cover page). The '234 Application claims priority as a continuation of Application Serial No. PCT/US2022/029280, filed on May 13, 2022, and provisional Application Serial No. 63/188,794, filed May 14, 2021. (EX-1001, cover page). The earliest effective filing date to which any of the Challenged Claims could be entitled is, therefore, May 14, 2021. It follows that the patentability of the Challenged Claims is governed by the provisions of the Leahy-Smith America Invents Act ("AIA"). MPEP § 2159.02.

For purposes of this petition, Petitioner does not challenge whether the Challenged Claims are entitled to claim the benefit of the May 14, 2021 effective filing date of the '794 Provisional but reserves the right to do so in this or other proceedings if necessary. Dr. Storey was asked to assume, for the purposes of his opinions, that the '422 Patent's effective filing date is May 14, 2021. (EX-1004 ¶ 38). Each reference relied on herein qualifies as prior art under AIA 35 U.S.C. § 102 under the May 14, 2021 effective filing date.

A. **Alleged Problem:** According to the '422 Patent, prior art heat shrink labels for packaging have failed to produce labels capable of being both light blocking and recyclable with PET containers. (EX-1001, 1:15-28; EX-1004 ¶ 39). The patent asserts that prior solutions often hindered recyclability. (EX-1004 ¶ 39; EX-1001, 1:15-28).

B. **Alleged Invention:** The '422 Patent purports to solve this alleged problem with a multi-layer recyclable heat shrink label. (EX-1004 ¶ 40; EX-1001 Abstract; 1:37-2:44). The '422 Patent describes its invention as generally comprising a heat shrink film, preferably comprising PET, and a light blocking layer disposed adjacent to one surface of the film. (EX-1001, Abstract; 6:33-57, 9:15-18; EX-1004

¶¶ 40-41). This light blocking layer is stated to be configured to block at least 80% of light between 200nm to 900nm. (EX-1001, 28:21-37, 30:7-19). The specification explains that, in some embodiments, the light blocking layer includes particles (e.g., metal, metal oxide, carbon black) that absorb light, while in other embodiments, the label includes a high opacity layer with a white pigment that blocks light. (EX-1001, 28:21-37, 30:7-19; EX-1004, ¶ 41). A key assertion of the '422 Patent is that its labels are "recyclable with a PET container," alleging that during standard PET recycling (e.g., a caustic wash), the ink and coating layers, including the light blocking layer, are intended to separate cleanly from the PET base film. (EX-1001, Abstract, 2:56-61, 19:53-20: 20; EX-1004, ¶¶ 41 "*Recyclability*", 42). The patent attempts to distinguish this from prior art allegedly incorporating light-blocking materials into the film itself. (EX-1004 ¶ 42).

C. **<u>Prosecution History</u>:** A review of the prosecution history of the '422 Patent (EX-1002, EX-1003) provides context for the examination, including the prior art considered by the USPTO Examiner and the arguments presented by PO that led to the allowance of the claims. (EX-1004 ¶ 44).

In a First Office Action, the Examiner rejected claims 1-11 and 13-18 as obvious over U.S. Pat. Pub. 2017/0223879 ("Mitchell I"). (EX-1002, 224-22; EX-1004 ¶ 45). The Examiner found that Mitchell I disclosed the structural features of claim 1 and determined that the recited term "recyclable" was not afforded patentable weight, either because it was a proposed use or because Mitchell I's labels would inherently be "recyclable." (EX-1002, 225; EX-1004 ¶ 45). Original claim 19, which at the time recited a heat shrink film comprised of PET, was not rejected over Mitchell I because the Examiner found Mitchell I did not disclose PET heat shrink film. (EX-1002, 63, 224; EX-1004 ¶ 45). The Examiner also rejected various claims as obvious over U.S. Pat. Pub. 2009/0233067 ("Doornheim") alone or in combination with U.S. Pat. Pub. 2016/0136934 ("Mitchell II"), or combinations involving Mitchell II, Mitchell I, and Japanese Patent Pub. No. 2004114498 ("Hashimoto"). (EX-1002, 228, 232; EX-1003, 3; EX-1004 ¶ 45).

To overcome these rejections, PO amended claim 1 to explicitly recite that the heat shrink film comprises PET and that the label is "recyclable with a PET container." (EX-1003, 83, 90, 94; EX-1004 ¶ 46). PO argued that the cited prior art failed to teach a PET heat shrink film and, importantly, that the limitation regarding the labels being "recyclable with a PET container" was structural and not disclosed by the cited art. (EX-1003, 90-94; EX-1004 ¶ 46). Specifically, PO attempted to distinguish its claimed invention by asserting that the cited art was not recyclable because, to the extent each taught light blocking, they did so by embedding light blocking material into the film itself, which PO contended could not be removed by a caustic wash and would contaminate the PET recycling process. (EX-1003, 89-90, 92, 94; EX-1004 ¶ 46). This was contrasted with the '422 Patent's alleged use of a separate, adjacent layer for the light blocking material. (EX-1003, 89-90, 92, 94; EX-1004 ¶ 46). Notably, none of the '422 Patent's claims are limited to caustic wash methods of recyclability. As will be detailed in the Grounds below, the prior art includes explanations of various recycling techniques and references for recycling PET films, including those with light blocking materials effectively embedded within them.

In a Second Office Action, the Examiner cited Japanese Pat. Pub. JP2009-214535A ("Sasaki") and rejected numerous claims, including amended claim 1, as anticipated or obvious. (EX-1003, 114, 116, 119, 121; EX-1004 ¶ 47). The Examiner found that Sasaki disclosed all of the features of amended claim 1, again noting that "wherein the recyclable shrink label is recyclable with a PET container" is functional language related to an intended use, which adds no patentable weight, or that Sasaki's disclosed structure would inherently perform the recited use. (EX-1003, 114-15; EX-1004 ¶ 47).

In response, PO reasserted its view that "recyclable with a PET container" was structural yet failed to identify specific structural limitations that made the claimed label recyclable. (EX-1003, 184-185; EX-1004, ¶ 48). Instead, PO merely alleged that incorporating light blocking particles into the heat shrink film would result in an unrecyclable label and argued that Sasaki taught away from the invention by allegedly using void spaces within the film for light blocking, rather than particulates in an adjacent layer. (EX-1003, 184-185; EX-1004 ¶ 48). Despite these arguments, PO amended claim 1 to include the limitations of then-pending claims 12 and 13, which recited light blocking components in the light blocking layer having a size between 0.1μm and 100μm and being comprised of a metal, metal oxide, reflective pigment, carbon black, mica, or a combination thereof. (EX-1003, 177-178; EX-1004, ¶ 48). PO also added claim 27 (now issued claim 19), which recited all the features of claim 1, except it replaced the light blocking particles with a high-opacity layer comprising white pigment, arguing Sasaki also taught away from such a layer. (EX-1003, 180; 185; EX-1004, ¶ 48).

In allowing the claims, the Examiner accepted PO's arguments distinguishing Sasaki. (EX-1003, 197; EX-1004, ¶ 49). The Examiner appeared satisfied that the prior art of record failed to teach a label with a heat shrink film comprising PET and a separate, adjacent layer having specific light blocking particles (or a high-opacity layer) that was also "recyclable with a PET container." (EX-1004, ¶ 49).

This perceived gap in the prior art considered by the Examiner is addressed by the references presented in this petition. (EX-1004, ¶ 50). Specifically, the Schurr reference (EX-1006), and the combination of Kitano (EX-1007) with Lee (EX-1010), provide clear teachings or strong suggestions for this combination of elements—a PET-based heat shrink film, separate adjacent light-modifying layers, and disclosed recyclability—when viewed by a POSITA considering the state of the art at the time. (EX-1004, ¶¶ 51-54). These references are therefore highly pertinent to the patentability of the Challenged Claims. (EX-1004, ¶ 55).

D. **The Claims**:

The limitations recited in the Challenged Claims are set forth above in the Table of Limitations for Challenged Claims above. Each of those limitations can be found in the prior art references relied upon in this petition. An explanation of why the Challenged Claims should be found unpatentable and the evidence supporting that contention are described in Section VII below.

V. LEVEL OF ORDINARY SKILL IN THE ART

Based on the factors commonly considered when determining the level of skill of a POSITA, including (a) the types of problems encountered by those working in the field and prior art solutions to those problems; (b) the sophistication of the technology in question and the rapidity with which innovations occur in the field; (c) the education level of active workers in the field; and (d) the education level of the inventor, Petitioner submits that the level of skill for a POSITA of the subject matter of the '422 Patent would be a Bachelor's degree in chemistry, chemical engineering, polymer science, or related field, and two years' of experience designing, manufacturing, or evaluating heat shrink film used for packaging or labeling containers. Petitioner further submits that additional education could compensate for lack of experience in the field or additional experience in the field could compensate for less education. (EX-1004, ¶¶ 36-37).

VI. OVERVIEW OF THE STATE OF THE ART AND PRIMARY REFERENCES

As of May 2021, a POSITA would have understood the significant industry need for packaging solutions for light-sensitive products in PET containers that were also compatible with established PET recycling streams. (EX-1004, ¶¶ 61-63, 66). The POSITA would have been aware of the challenges light exposure posed to product quality and the strong drive towards enhanced recyclability of all packaging components, including labels. (EX-1004, ¶¶ 62-63). Standard techniques for light-blocking, such as incorporating pigments like carbon black, TiO_2, or metallic particles into distinct layers of a label, were well known. (EX-1004, ¶ 65). The field of heat shrink labels for packaging, particularly PET-based labels addressing light protection and recyclability, was well-developed, with numerous prior art references describing relevant material compositions, layered structures, and functional properties. (EX-1004, ¶ 67).

Below are overviews of the primary references.

A. Schurr

Schurr discloses a heat shrink film for wrapping containers to protect light-sensitive contents while maintaining recyclability. (EX-1006, 1:3-10, 1:60-63, 2:3-11, 7:59-8:15, 8:32-33; EX-1004, ¶¶ 51, 70). The heat shrink film, having a thickness of 20μm to 100μm, comprises a first polymer ply with a dark pigment and a second polymer ply with a white pigment, the combination of which provides light blocking properties. (EX-1006, Abstract, 3:17-35; EX-1004, ¶ 71). Both polymer plies may comprise the same polymer, such as PET. (EX-1006, 12:43-50, 2:50-55, 2:62-64, 3:3-5; EX-1004, ¶ 71).

Schurr discloses that a first ply containing the dark pigment (e.g., carbon black with a particle size up to 0.1μm (EX-1006, 6:44-50)) may be arranged facing a wrapped container, while the second ply containing the white pigment (e.g., titanium dioxide with a particle size of 0.2 to 0.8μm (EX-1006, 7:29-32)) faces outward, providing a white surface suitable for printing. (EX-1006, 15:64-16:10; EX-1004, ¶ 71). Accordingly, a smaller proportion of light reaches the first polyester ply and, owing to the dark pigment content thereof, help protect the container from incidence of light. (EX-1006, 16:6-10). Schurr teaches that the light transmission of the film is "not more than 12%, for example not more than 10%, preferably not more than 5%," or "for instance not more than less than 1%, in relation to a wavelength range of 360nm to 750nm." (EX-1006, 7:64-67; EX-1004, ¶ 71).

Schurr emphasizes the recyclability of its film, stating it "can be recycled easily," and that waste material can be added back to the first polymer ply. (EX-1006, 8:32-39; EX-1004, ¶ 72). Schurr further describes that its film material can be separated from transparent objects like PET containers during recycling using known processes, for example, based on differing densities. (EX-1006, 15:54-63; EX-1004, ¶ 72).

Schurr is prior art at least under AIA §102(a)(2) because its effective filing date is the December 5, 2016 filing date of its PCT application, and is a patent issued under 35 U.S.C. §151. (EX-1006, [Cover]; EX-1004, ¶ 68).

B. Kitano

Kitano discloses a layered laminate with light blocking properties for packaging applications, including as a heat shrink label applied to containers like PET bottles. (EX-1007, Abstract, [0006]-[0008], [0012], [0028]-[0031], [0034]-[0038]; EX-1004, ¶¶ 51, 74-75). The laminate includes a substrate layer, a shielding layer, and a light shielding layer. (EX-1007, Abstract, [0006]-[0008], [0012], [0028]-[0031], [0034]-[0038]; EX-1004, ¶ 75). Kitano teaches that the substrate layer can be a heat-shrinkable resin film, preferably PET film. (EX-1007, [0012], [0014]; EX-1004, ¶ 75).

The light shielding layer is composed of light shielding ink containing binder resin and aluminum particles that protects packaged contents susceptible to photodegradation (EX-1007, [0020], [0032]-[0033]) by reflecting light that passes through the substrate and shielding layer (EX-1007, [0018]-[0020]; EX-1004, ¶ 75). Kitano discloses flaked particle sizes of 7μm with an average thickness of 0.2μm (EX-1007, [0034], [0038]) that block at least 80% of incident light in the wavelength range of 500-600nm. (EX-1007, [0020]; EX-1004, ¶ 76).

As a Japanese unexamined patent application published on June 29, 2017, Kitano is prior art at least under AIA 35 U.S.C. §102(a)(1). (EX-1007, [Cover]; EX-1004, ¶ 68).

C. <u>Lee</u>

Lee discloses a polyester resin blend and films made therefrom, specifically for heat-shrinkable labels that are compatible with PET container recycling streams. (EX-1010, [0004]; EX-1004, ¶¶ 51, 78). Lee explicitly addresses the problem that conventional heat-shrinkable labels can cause "a fusion phenomenon that sticks to the container in the process of drying the container after washing in the recycle process of the polyethylene terephthalate container," thereby making recycling impossible. (EX-1010, [0004]; EX-1004, ¶ 78).

To solve these problems, Lee discloses a polyester resin blend comprising PET and a specific copolyester resin engineered with particular comonomers designed to control the film's crystallization behavior. (EX-1010, Abstract, [0008]-[0009], [0013]-[0014]; EX-1004, ¶ 79). A key teaching of Lee is that its heat-shrinkable label "can be reused while attached to a PET container, etc." and "can be supplied to the recycle stream of the PET container while being attached to the PET container," thus avoiding the "troublesome process of separating the label from the container." (EX-1010, Abstract, [0003], [0010], [0020]; EX-1004, ¶ 80). Lee explains this is possible because its film, due to its controlled crystallization properties, "can be crystallized even at high drying temperatures typical in PET recycling, preventing fusion." (EX-1010, [0020]; EX-1004, ¶ 80). Lee also describes its film as having "excellent shrinkage properties." (EX-1010, Abstract; EX-1004, ¶ 80).

Lee was published on December 8, 2022, but claims priority to Korean application KR 10-2018-0149230, filed November 27, 2018. Lee is prior art at least under AIA 35 U.S.C. §102(a)(2) based on this priority date. (EX-1010, [Cover]; EX-1004, ¶ 68).

VII. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. Ground 1: Claims 1-19 Are Obvious Over Schurr in View of the Knowledge and Skill of a POSITA

Schurr teaches or suggests nearly all limitations of claims 1-19, including a multi-layer, light-blocking, heat-shrinkable polyester film with a dark-pigmented first ply and a white-pigmented second ply, providing an effective light barrier for packaging. (EX-1006, Abstract, Claim 1). Critically, Schurr states that its film "can be recycled easily." (EX-1006, 8:32-36; EX-1004, ¶ 82). The knowledge of a POSITA is invoked to bridge any minimal gaps, primarily related to achieving specific quantitative performance metrics recited in the claims (e.g., the precise light blocking percentage over the claimed 200-900nm range, specific shrinkage values at 100°C, and coating amounts expressed in "ppr") through well-known, routine optimization and characterization techniques. (EX-1004, ¶ 83). POSITA knowledge is also relevant to confirming or selecting specific material choices (e.g., ensuring the film consists of PET or possesses sufficient crystallizability) to ensure compatibility with standard PET container recycling streams, a well-understood industry objective. (EX-1004, ¶ 83). As detailed below, a POSITA would have been motivated to apply this knowledge to Schurr's teachings to arrive at the claimed invention with a reasonable expectation of success. (EX-1004, ¶ 83).

1. Motivation to Apply POSITA Knowledge to Schurr and Reasonable Expectation of Success

A POSITA seeking recyclable packaging for light-sensitive products in PET bottles would be motivated to apply ordinary skill and knowledge to Schurr's teachings to reach the invention claimed in claims 1-19. (EX-1004, ¶ 84). Schurr provides a strong starting point: a light-blocking, multi-layer, polyester-based, heat-shrinkable label described as "recycled easily." (EX-1006, Abstract; 8:32-36; EX-1004, ¶ 85). A POSITA's motivations to make necessary modifications or confirmations arise from, for example, routine optimization, addressing known problems in the art, responding to market pressures, and applying known principles and techniques consistent with *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398 (2007). (EX-1004, ¶ 86). Furthermore, the art before the earliest priority date of the '422

Patent was replete with a recognized need for improvements to recycling PET materials, especially those with additives such as titanium dioxide or carbon black, as described in the '422 Patent. (EX-1004, ¶¶ 84, 87, 89, referencing EX-1012 and EX-1013). This need was particularly strong in Europe, where initiatives like the Green Deal, unveiled in 2019 by the European Commission, sought to make the European Union carbon neutral by 2050 and intensified pressure on the packaging industry to enhance recyclability. (EX-1004, ¶ 87, citing EX-1011). PET waste was recognized at the time as a significant problem to overcome in order to achieve such goals, with a strong impetus to transition to a circular economy that retains plastics like PET in their highest value condition to reduce environmental impacts. (EX-1004, ¶ 87, citing EX-1012, p.1-2; EX-1013, p. 5376, col. 1). In addition, Lee, though not relied upon as a primary reference for this Ground, describes the desire in the art for "recyclable polyester films such as [for] polyethylene terephthalate containers…" (EX-1010, [0005]), further evidencing the well-understood industry demand.

These general motivations are further crystallized when considering specific, well-understood industry needs and practices that a POSITA would have applied to Schurr's teachings:

The Need for PET Recycling Compatibility: The large PET container market and recognized environmental concerns stemming from PET waste created significant incentives for recyclable packaging components like labels. (EX-1004, ¶ 90). By May 2021, it was a fundamental understanding in the packaging and polymer industries that the massive scale of PET container usage generated immense market and regulatory pressure for sustainable solutions. (EX-1004, ¶ 90, citing EX-1012, p. 1-2; EX-1013, p. 5376, col. 1). This necessitated that labels be fully compatible with established PET recycling infrastructure to prevent contamination of the recycled PET flake, a known and significant technical and economic problem. (EX-1004, ¶ 90, citing EX-1012, p. 4, 5; EX-1013, p. 5376, col. 2). Starting with Schurr's "easily recycled" polyester-based film (EX-1006, 8:32-36), a POSITA would be strongly motivated to rigorously confirm and, if necessary, optimize this compatibility for co-recycling with PET bottles, ensuring no detrimental effects during caustic wash or melt reprocessing. (EX-1004, ¶ 90, citing EX-1012, p. 7-8). This would naturally lead to obvious choices like using PET as the sole film polymer (as recited in claim 5) and selecting a crystallizable PET grade (as recited in claim 18) to enhance recyclability. (EX-1004, ¶¶ 83, 90, 92 third bullet point).

Indeed, while general plastic recycling was a known challenge, particular issues with PET recycling processes, especially with additives, were also well-recognized, and solutions were being actively pursued. (EX-1004, ¶¶ 63-64, 89, 90). For example, a POSITA would have understood that the recycling needs for PET and additives like titanium dioxide (a light blocking material in the '422 Patent) could differ, potentially requiring separation or special considerations. (EX-1004, ¶ 63, citing EX-1012, p. 4, 7). Similarly, PET with additives such as carbon black was known to pose recycling complexities due to differing requirements and the potential for contamination. (EX-1004, ¶ 64, citing EX-1013, p. 5376, col. 2). However, solutions like chemical recycling processes, capable of separating such additives (e.g., carbon black) from the PET stream, were also known and being implemented. (EX-1004, ¶¶ 64, 89, citing EX-1013, Abstract, p. 5377, p. 5387). Furthermore, the problem of amorphous polyester films causing fusion issues during PET container recycling, as described by Lee (EX-1010, [0004]), would further motivate a POSITA to ensure any PET film used was suitably crystallizable to facilitate co-recycling without requiring label separation, a convenience Lee also highlights. (EX-1010, [0004]; EX-1004, ¶ 92, third bullet point). In view of this known landscape of problems and emerging solutions, a POSITA would be motivated to adapt Schurr's teachings to ensure full PET recycling compatibility.

The Need for Broad-Spectrum Light Protection: Light exposure of edible, spoilable contents in containers has long been known to cause or accelerate spoilage or affect flavors. (EX-1004, ¶ 90, citing EX-1014, Abstract, lines 51-53, 68-70). It is particularly understood that exposure to light in the UV-visible range can activate complex photo-degradative reactions. (EX-1004, ¶ 90, citing EX-1014, Abstract, lines 51-53, 68-70). While Schurr demonstrates high light blocking (e.g., ≥88%

transmission reduction) in the 360-750nm range (EX-1006, 7:62-8:15), a POSITA would recognize that protecting diverse products often requires broader spectrum blocking, including UV radiation (200-400nm), a primary driver of photodegradation, and potentially NIR radiation (750-900nm), which can contribute to undesirable heating. (EX-1004, ¶ 90). This fundamental need for comprehensive light protection provides a direct motivation to ensure a Schurr-based label design would effectively block light across the broader 200-900nm range specified in the '422 Patent claims. (EX-1004, ¶ 90). A POSITA would know that achieving ≥80% blockage across this wider spectrum, using pigments taught by Schurr like carbon black (known for exceptional broadband absorption) or other standard light-blocking particulates, would be a matter of routine formulation and process optimization. (EX-1004, ¶¶ 90, 92 first bullet point,).

Application of Standard Industry Practices and Material Characterization: Motivation would also arise from the routine need to characterize product performance using standard industry metrics and conditions. A POSITA developing a shrink label based on Schurr would, as a standard part of the development process, evaluate its thermal shrinkage properties under conditions representative of industrial use, such as at 100°C (a common temperature for shrink tunnels, directly relevant to claims 8, 9, and 17). (EX-1004, ¶ 90). Similarly, quantifying coating amounts or active components using standard units like ppr (pounds per ream, as recited in claims 12 and 13) is routine practice in material specification, coating formulation, and quality control. (EX-1004, ¶ 90). Such performance metrics are the result of optimizing known parameters and represent standard product development steps, not inventive leaps. (EX-1004, ¶¶ 90, 92 fourth bullet point).

Consideration of Known Design Alternatives for Functional Benefit: In label design, a POSITA would be motivated to consider known structural alternatives to achieve functional benefits. For instance, regarding indicia layer placement (claim 16), a POSITA would be thoroughly familiar with reverse printing—applying ink to the film's inner surface (first surface). This is a common and well-established alternative to surface printing, with a strong, understood technical motivation: it protects the printed graphics from abrasion and environmental factors. (EX-1004, ¶¶ 90, 92 fifth bullet point). Selecting reverse printing is an obvious and established design choice. (EX-1004, ¶ 90).

A POSITA viewing Schurr's disclosure would have possessed a strong and reasonable expectation of success in applying these routine optimizations and known techniques. (EX-1004, ¶ 91). This expectation stems from Schurr's use of a PET-based film and common light-blocking pigments—materials generally understood by a POSITA to be manageable within, or adaptable to, PET recycling paradigms, especially when applied in distinct layers as Schurr teaches. (EX-1004, ¶ 91). Schurr itself clearly demonstrates the fundamental feasibility of creating a light-blocking, polyester-based shrink film structure. (EX-1004, ¶ 91). The subsequent steps to achieve the specific performance metrics and material compositions of the '422 Patent claims would involve the application of well-understood principles and would not have required more than the ordinary skill of a POSITA using routine, predictable experimentation and optimization. (EX-1004, ¶ 91).

The path from Schurr's teachings to the specific limitations of the '422 Patent claims would involve applying well-understood scientific and engineering principles common in polymer science, material formulation, and label manufacturing, leading to predictable outcomes. (EX-1004, ¶ 92). For example:

- The broadband light absorption properties of common pigments like carbon black (taught by Schurr and known for effectiveness across UV, visible, and NIR spectra) are fundamental concepts. Adjusting pigment concentration or layer thickness to modify light transmission follows predictable physical laws (e.g., Beer-Lambert law), making achievement of specific blockage levels a matter of routine formulation. (EX-1004, ¶ 92, first bullet point).

- The thermal shrinkage behavior of oriented polyester films like PET is well-characterized. Minor adjustments to processing or testing at standard temperatures (like 100°C vs. Schurr's 95°C) would yield predictable trends in shrinkage. (EX-1004, ¶ 92, second bullet point).

- Inherent PET properties, including crystallizability, are well-established. Selecting PET grades for desired characteristics like recycling compatibility (as highlighted by Lee, EX-1010) is standard practice. (EX-1004, ¶ 92 third bullet point).

- Converting performance metrics to units like ppr involves routine calculations based on material density, layer thickness, and area. (EX-1004, ¶ 92, fourth bullet point).

- Label manufacturing techniques like multi-layer coextrusion, coating application, printing (surface and reverse), and seaming are established industrial processes. (EX-1004, ¶ 92, fifth bullet point).

Therefore, combining Schurr's effective starting point with the clear motivations driven by known industry needs (such as achieving full PET recycling compatibility and ensuring broad-spectrum light protection) through the application of a POSITA's ordinary skill—utilizing standard and predictable optimization techniques, common material characterization methods, and recognized design alternatives—provides a clear and direct path to the subject matter of claims 1-19 of the '422 Patent. (EX-1004, ¶ 93). A POSITA would have reasonably expected success because each step involves leveraging known materials, established scientific principles, and standard industry practices to meet well-defined performance targets, without any indication of unexpected technical hurdles. (EX-

1004, ¶ 93).

2. Claims 1 and 19

Claims 1 and 19 are substantially similar, differing only in that claim 1 recites specific particulate requirements for the light blocking component ([1-5], [1-6]) while claim 19 instead requires a high opacity layer comprising a white pigment ([19-5]). (EX-1004, ¶ 95). Accordingly, the common limitations between the two claims are addressed together below, while the unique limitations are handled separately.

a. [1-PRE], [19-PRE]

The preamble—"[a] recyclable shrink label comprising"—merely states an intended use. Because the claim body fully defines the invention, the preambles are not limiting. *Shoes by Firebug LLC v. Stride Rite Children's Grp., LLC*, 962 F.3d 1362, 1367 (Fed. Cir. 2020). Even if it were, Schurr discloses a "heat-shrinkable film" (EX-1006, Abstract; 1:3-5) for wrapping objects like bottles (EX-1006, 1:6-8) and suitable for printing indicia (EX-1006, 1:9-11; 1:49-54), consistent with a shrink label. (EX-1004, ¶ 96). And Schurr expressly teaches: "the film overall can be recycled easily." (EX-1006, 8:32-36). From a technical perspective, Schurr's disclosed film is accurately described as a recyclable shrink label. (EX-1004, ¶ 96).

b. [1-1]/[19-1], [1-2]/[19-2]

Schurr describes a "heat-shrinkable film" comprising "polyesters" formed from components including "terephthalic acid" and "1,2-ethanediol" (ethylene glycol)—the monomers forming PET. (EX-1006, Abstract, 2:59-3:12; EX-1004, ¶ 98). Schurr also describes opposite "surfaces which face away from each other of the first polymer ply A and of the second polymer ply B," meaning its film inherently possesses opposed first and second surfaces. (EX-1006, Claim 3; EX-1004, ¶ 98).

Moreover, Schurr's disclosed film thickness renders the claimed range obvious. Schurr teaches "the film has a thickness of 20μm bis [to] 100μm," repeated in its claim 1. (EX-1006, Abstract, 7:47–58; EX-1004, ¶ 99). This range (20-100 μm) establishes prima facie obviousness for the claimed 15μm—100μm range, as Schurr's range significantly overlaps and falls within it. *E.I. DuPont de Nemours & Co. v. Synvina C.V.*, 904 F.3d 996, 1006 (Fed. Cir. 2018). A POSITA would readily understand that selecting a film thickness slightly below Schurr's explicit lower value of 20μm (e.g., 15μm) is a routine design parameter, would be technically feasible, and would provide similar performance characteristics, as there is typically no sharp change in properties or unexpected result from such a minor variation. (EX-1004, ¶ 99).

c. [1-3]/[19-3]

Schurr discloses a light blocking layer adjacent the first surface, comprising a light blocking component. (EX-1004, ¶ 100). Schurr's film includes a "first polymer ply A which comprises at least one dark pigment" and a "second polymer ply B, which comprises at least one white pigment." (EX-1006, Abstract, 2:20-24; EX-1004, ¶ 101). Ply A, with dark pigments like "fine metal particles" or "carbon black" (EX-1006, 6:18-30), constitutes the claimed "light blocking layer comprising a light blocking component." (EX-1004, ¶ 101). Schurr describes Ply A as facing the object being wrapped (EX-1006, 15:64-67); thus, in typical application, Ply A is disposed adjacent the first surface (the container-facing surface). (EX-1004, ¶ 101). Thus, Ply A is "adjacent" the first surface under the '422 Patent's definition, which states "[t]he term 'adjacent' is used here to indicate which the[sic] side of the label the layer is closest" and further clarifies that "[a]dditional optional layers may be disposed between adjacent layers." (EX-1001, 6:51-57; EX-1004, ¶ 101).

d. [1-4]/[19-4]

Schurr discloses that its light blocking layer is constructed to block at least 80% of incident light from 200nm to 900nm, or renders this feature obvious. (EX-1004, ¶ 102). Schurr teaches high light blocking, with light transmission of "not more than 12%" (i.e., ≥88% **blocking**) over 360-750nm. (EX-1006, Abstract; 7:62-66; 8:4-10; EX-1004, ¶ 103). Schurr teaches using "soot and/or carbon black" in Ply A. (EX-1006, 6:28-30; 7:33-38). Carbon black is known by a POSITA as a strong, broadband absorber across the UV, visible, and near-infrared spectrum (200-900nm). (EX-1004, ¶ 103). A Schurr film using carbon black, already achieving ≥88% blocking in the visible spectrum (360nm-750nm), would ***inherently*** exhibit strong blocking (well above 80%) across the entire recited 200-900nm range due to carbon black's fundamental optical properties. (EX-1004, ¶ 103).

Alternatively, achieving the claimed performance is obvious. Schurr targets a "light-tight" film (EX-1006, Title) and shows high blocking (≥88%). (EX-1004, ¶ 104). A POSITA, recognizing the need for broad-spectrum protection (200-900nm) for light-sensitive products (EX-1004, ¶ 90), would be motivated to ensure Schurr's film met this requirement. (EX-1004, ¶ 104). Using Schurr's taught pigments (carbon black, metal particles) known for broad absorption, a POSITA could readily achieve ≥80% blocking across 200-900nm via routine optimization of pigment concentration and/or layer thickness—predictable variations of Schurr's effective system, governed by well-established principles like the Beer-Lambert law. (EX-1004, ¶ 104).

e. [1-5]

Schurr teaches dark pigments that are particulate and have a particle size within or overlapping the claimed 0.1μm to 100μm range. Schurr discloses "fine metal particles … with a diameter of up to not more than a few micrometers" (EX-1006, 6:18-22) and "soot and/or carbon black" with an "average particle diameter...preferably within a range of 20nm [0.02μm] to 100nm [0.1μm]" (EX-1006, 6:47-50). (EX-1004, ¶ 105). Schurr's disclosed ranges (0.02μm up to "a few micrometers") significantly overlap and include the claimed 0.1μm to 100μm range, establishing prima facie obviousness. *DuPont*, 904 F.3d at 1006. Selecting a specific size within this broad range disclosed or suggested by Schurr is a routine parameter in pigment formulation. (EX-1004, ¶ 105).

f. [1-6]

Schurr explicitly discloses that the dark pigment particulate includes "fine metal particles," metal oxides ("iron oxide brown or iron oxide black," "spinel black"), and "soot, in particular carbon black." (EX-1006, 6:18-30). These directly meet the claimed options. (EX-1004, ¶¶ 106-107).

g. [19-5]

Schurr discloses a high opacity layer comprising a white pigment by teaching a film that includes "a second polymer ply B, which comprises at least one white pigment." (EX-1006, Abstract; 2:20-24; Claim 1; EX-1004, ¶¶ 108-109). Schurr explains Ply B functions as a high opacity layer by preventing the underlying dark pigment Ply A from showing through, ensuring Ply B "actually appears white." (EX-1006, 8:48–58). This function of masking and providing a white appearance defines a high opacity layer with white pigment, corroborated by the film's low light transmission. (EX-1004, ¶ 109).

h. [1-7]/[19-6]

Schurr explicitly states its film "overall can be recycled easily." (EX-1006, 8:32-36; EX-1004, ¶ 112). More importantly, Schurr describes compatibility with recycling transparent objects like PET containers via density separation: "When the object is recycled, the material of the films or hoses can be separated from the material of the transparent object by processes known in the art, for example on the basis of differing densities…." (EX-1006, 15:54-63; EX-1004, ¶ 112). Density-based separation (float/sink) is a standard method in PET container recycling to separate PET flake from labels. (EX-1004, ¶ 111, generally discussing industry guidelines like APR/Petcore). By disclosing a film designed for easy recycling via density separation—a key mechanism for label removal in PET container recycling—Schurr teaches a label constructed for compatibility and separability within standard PET recycling, i.e., "recyclable with a PET container." (EX-1004, ¶ 112).

Alternatively, or additionally, ensuring Schurr's label was "recyclable with a PET container" would be obvious. A POSITA would understand this term in the context of established industry practices (EX-1004, ¶ 111, citing EX-1012 generally) aimed at preventing contamination of the PET recycling process. Starting with Schurr's PET-based film ([1-1]/[19-1]) taught as "recycled easily" (EX-1006, 8:32-36), a POSITA applying it to PET containers would be motivated by industry demands to ensure full compatibility with PET recycling streams. (EX-1004, ¶ 114). This involves obvious material selection (PET film, compatible pigments taught by Schurr) and designing the construction for effective density separation or other compatibility mechanisms—predictable outcomes from known principles. (EX-1004, ¶ 114).

The Patent Owner's prosecution arguments—that including light blocking materials *embedded* in PET film renders it unrecyclable by caustic wash—are misplaced and factually incorrect regarding Schurr and the state of the art. Schurr's layered construction, with pigments in discrete plies (EX-1006, Abstract, 2:18-24), is fundamentally different from integrally pigmented films and is ***more amenable*** to separation or management during recycling, including caustic washing if layers are designed for deinking/delamination. (EX-1004, ¶ 113). Indeed, the art before the '422 Patent's filing date recognized that recycling PET even with challenging additives like carbon black ***was*** workable. For example, when discussing its tertiary recycling process (i.e., depolymerization via alkaline hydrolysis), Ügdüler (EX-1013) taught that "by using the optimized alkaline hydrolysis with further cleaning processes different types of colours, including carbon black are removed from the hydrolysate successfully." (EX-1013, Abstract, see also p. 5387; EX-1004, ¶¶ 89, 113). Thus, PO's assertion that pigments in the heat shrink film inherently ruin recyclability is contradicted by Schurr's own disclosure of an "easily recycled" pigmented PET-based film and by the broader knowledge of a POSITA regarding successful recycling of pigmented PET. (EX-1004, ¶¶ 113-114). The claims, moreover, do not impose specific requirements on the ultimate purity or transparency of the recycled PET output beyond what is generally acceptable. (EX-1004, ¶ 115). Adding PET from a container to the recycling stream of Schurr's PET-based, "easily recycled" label would not adversely affect recyclability. (EX-1004, ¶¶ 93, 114).

3. Claim 2

Schurr discloses an indicia layer both functionally and structurally. (EX-1004, ¶ 116). Functionally, Schurr states its films allow printing "to indicate the contents of the wrapped object," as an indicia layer would. (EX-1006, 1:9–11; 12:66–13:5 (printing motifs); EX-1004, ¶ 117). Structurally, Schurr's claim 1 recites a "[h]eat-shrinkable … film consisting of: … at least one pigment ply consisting of pigments applied to the second polymer ply B." (EX-1006, Claim 1). Read in the context of Schurr's discussion of printing information onto the film, this defined "pigment ply" applied to the outer-facing Ply B represents the layer where graphical or textual indicia would be printed. (EX-1004, ¶ 118).

4. Claim 3

Schurr discloses a high opacity layer comprising a white pigment, as discussed *supra* at Section VII.A.2.g for limitation [19-5]. (EX-1004, ¶¶ 119-120). Schurr's Ply B, comprising a white pigment and functioning to obscure the underlying dark layer so Ply B "actually appears white," is the claimed high opacity layer. (EX-1006, Abstract, 2:21-22, 8:46-58; EX-1004, ¶ 120).

5. Claim 4

Schurr discloses the label of claim 3 also comprising an indicia layer, with the high opacity layer between the indicia and light blocking layers. (EX-1004, ¶ 121). Schurr's own claim 1 explicitly includes the indicia layer (as the "at least one pigment ply … applied to the second polymer ply B"). (EX-1006, Claim 1). Schurr specifies film orientation where Ply A (the light blocking layer) faces the object, while Ply B (the high opacity layer) faces away and "can be printed on." (EX-1006, 15:64–16:10). In this configuration, the indicia layer (printed on Ply B) is outermost, the high opacity layer (Ply B) is underneath it, and the light blocking layer (Ply A) is innermost. This necessarily places the high opacity layer (Ply B) directly ***between*** the externally applied indicia layer and the internal light blocking layer (Ply A), as recited in claim 4. (EX-1004, ¶ 121).

6. Claim 5

Schurr teaches a heat shrink film that consists of polyethylene terephthalate (PET), or renders this obvious. (EX-1004, ¶ 122). Schurr's film is polyester-based (EX-1006, 2:59-3:6), defining polyesters as including those formed from "terephthalic acid" and "1,2-ethanediol"—PET monomers. (EX-1006, 2:62-64, 3:6-12; EX-1004, ¶ 123). Both Ply A and Ply B comprise these polyesters. (EX-1006, 2:18-22; 3:1-6; 3:22-27). Thus, the primary polymer forming Schurr's film is PET. (EX-1004, ¶ 123). The term "consists of" modifies "heat shrink film" regarding its polymer identity (PET) but does not exclude the required non-polymeric pigments in Ply A and B fundamental to Schurr's structure. *See Mannesmann Demag Corp. v. Engineered Metal Prods. Co.*, 793 F.2d 1279, 1282 (Fed. Cir. 1986). (EX-1004, ¶ 123).

Alternatively, or additionally, even if Schurr allowed polyester combinations, selecting PET as the ***sole*** polymeric component for the heat shrink film would be an obvious design choice. (EX-1004, ¶ 124). A POSITA, strongly motivated by the industry need for maximal recyclability with PET containers (as discussed *supra* for limitations [1-7]/[19-6]) and starting with Schurr's PET-based film taught as "recycled easily" (EX-1006, 8:32-36), would find using only PET for the entire film (Ply A and B) an obvious path to ensure optimal compatibility and minimize potential contamination in PET recycling streams. (EX-1004, ¶¶ 124-125). This ensures maximum material homogeneity using a suitable material explicitly contemplated by Schurr. (EX-1004, ¶ 125).

7. Claim 6

Schurr discloses the label in the form of a sleeve or tube. Schurr describes a "hose which comprises a heat-shrinkable film … in which two edges of a heat-shrinkable film are joined to each other." (EX-1006, 15:11–15). Schurr clarifies that this "hose" wraps objects like bottles. (EX-1006, 15:40-43). In the context of shrink labels for bottles, a "hose" formed by joining film edges is synonymous with the claimed "sleeve or tube." (EX-1004, ¶ 126).

8. Claim 7

Schurr discloses a sleeve or tube with a seam. As discussed for claim 6, Schurr forms the hose (sleeve/tube) by joining "two edges of a heat-shrinkable film," for example via "heat sealing or solution sealing." (EX-1006, 15:12–18). Joining film edges via sealing ***inherently*** creates a seam where edges meet and are bonded. (EX-1004, ¶¶ 127-128).

9. Claims 8 and 9

Claims 8 and 9 require the heat shrink film and the entire label, respectively, to shrink about 1-90% when heated to 100°C. Schurr, combined with POSITA knowledge, renders these limitations obvious. (EX-1004, ¶ 129). Schurr discloses significant shrinkage (20-85% at 95°C) for its film. (EX-1006, Abstract; 2:26-35; EX-1004, ¶ 130).

While Schurr does not explicitly state shrinkage at 100°C, determining this would have been a routine and straightforward task for a POSITA. (EX-1004, ¶ 131). Characterizing thermal shrinkage at standard temperatures like 100°C (a common temperature for industrial shrink tunnels) is a fundamental part of material evaluation for shrink films. (EX-1004, ¶ 131; EX-1009, [0063], [0078]). A POSITA would understand from general polymer science principles that Schurr's oriented polyester film would likely exhibit similar or slightly higher shrinkage at 100°C compared to 95°C. (EX-1004, ¶ 131). Given Schurr's substantial shrinkage (20-85%) at 95°C, a POSITA would reasonably and confidently expect shrinkage at 100°C to be significant and fall well within the exceptionally broad claimed 1-90% range. (EX-1004, ¶ 132). Confirming the precise value would involve nothing more than standard, routine laboratory testing. (EX-1004, ¶ 132).

Regarding claim 9 (shrinkage of the "entire recyclable shrink label"), a POSITA would understand that overall label shrinkage is overwhelmingly governed by the base heat shrink film itself, especially when additional layers (like Schurr's pigment plies or indicia) are relatively thin and designed to adhere and contract with the base film. (EX-1004, ¶¶ 133-134; EX-1009, [0063], [0078]). Therefore, the entire label structure disclosed by Schurr would be reasonably expected to show substantially the same shrinkage as the film itself, thus also falling well within the broad 1-90% range at 100°C. (EX-1004, ¶ 134).

10. Claim 10

Claim 10 requires the high opacity layer (from claim 3) to comprise a pigment selected from TiO_2, PCC, aluminum silicate, alumina, coated mica, or combinations thereof. Schurr describes its Ply B as a high opacity layer with white pigment and provides examples of suitable inorganic white pigments including calcium carbonate, titanium dioxide, or mixtures. (EX-1006, 7:8–11; EX-1004, ¶ 136). This list expressly includes TiO_2 and calcium carbonate (PCC being a common form of calcium carbonate), both recited in claim 10. (EX-1004, ¶ 136). Schurr's disclosure of TiO_2 and calcium carbonate/PCC, therefore, renders claim 10's selection obvious. *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986).

Furthermore, other options like aluminum silicate and alumina are well-known and common white pigments and fillers extensively used in polymer films and coatings, often with TiO_2, to modify opacity, brightness, processability, and cost. (EX-1004, ¶ 137). A POSITA formulating Schurr's Ply B would readily recognize these as standard, obvious choices to consider as alternatives or co-pigments alongside Schurr's listed pigments, involving routine formulation based on established material science. (EX-1004, ¶ 138). Coated mica, if unique optical effects were desired, would also be an obvious choice. (EX-1004, ¶ 138).

11. Claim 11

Claim 11 requires the light blocking component comprise zinc, aluminum, copper, silver (or alloy), TiO_2, carbon black, mica, reflective pigment, light-blocking polymer, light-blocking mineral, or combinations. Schurr renders this obvious. (EX-1004, ¶ 139). Schurr identifies suitable dark pigments for Ply A (light blocking component) including "fine metal particles," metal oxides ("iron oxide," "spinel black"), and "soot, in particular carbon black." (EX-1006, 6:18–30; EX-1004, ¶ 140). Schurr also lists TiO_2 as a white pigment. (EX-1006, 7:8-11). Schurr's "fine metal particles" encompass claimed metals like aluminum, zinc, copper, or silver/alloys.

(EX-1004, ¶ 141). Its metal oxides encompass the claimed "metal oxide" category. (EX-1004, ¶ 141). Schurr explicitly lists "carbon black" and "titanium dioxide." (EX-1004, ¶ 141). By disclosing multiple Markush group members (metal particles, metal oxides, carbon black, TiO_2) as suitable pigments, Schurr renders claim 11's selection obvious. *See Merck*, 800 F.2d at 1097.

Moreover, other options like "reflective pigment," "a polymer capable of blocking light," or "a mineral capable of blocking light" are functional descriptions. (EX-1004, ¶ 142). A POSITA would understand that materials taught by Schurr (e.g., fine metal particles as reflective pigments; carbon black or TiO_2 as light-blocking minerals) or other common materials known for such functions would inherently fall into these categories, making their selection an obvious approach. (EX-1004, ¶ 143).

12. Claims 12 and 13

Claims 12 and 13 require that the light blocking layer and component, respectively, be present in specified amounts expressed in ppr. Schurr, in combination with the knowledge and skill of a POSITA, renders these limitations obvious. (EX-1004, ¶ 144). Schurr discloses dark pigment concentrations (light blocking component) in Ply A (light blocking layer) in wt% relative to the film (e.g., "0.05 wt % to 3.0 wt %"). (EX-1006, 6:54-7:7; EX-1004, ¶ 145). Schurr does not use ppr (pounds per ream area density, as described in the '422 Patent, 5:44-47).

However, determining the necessary amount of light blocking material for

≥80% blocking (per [1-4]/[19-4]) and expressing it in standard areal density units like ppr would be obvious. (EX-1004, ¶ 146). Expressing coating/layer amounts in ppr is standard industry practice. (EX-1004, ¶ 146). A POSITA, having determined the required layer thickness and pigment concentration (wt%) to achieve desired light blocking based on Schurr, would find it a ***routine and elementary matter*** to calculate and express these amounts in ppr using known layer thickness (e.g., from Schurr's 20-100μm total film, with Ply A typically 5-50% thereof), known material densities, and the ppr definition. (EX-1004, ¶¶ 146-147). Arriving at an effective amount for the layer or component within the broad claimed ppr ranges (0.5-25 ppr layer; 0.1-10 ppr component) is the ***reasonably expected outcome*** of routine optimization and quantification for Schurr's system. (EX-1004, ¶ 148). For instance, Dr. Storey calculates that Schurr's Example 1 (with reasonable assumptions for layer and component densities and Schurr's stated layer thickness and component loading) would have a Ply A areal density of approximately 6.4 ppr (within claim 12's range) and, with appropriate pigment loading to achieve Schurr's >88% blocking, a carbon black component amount of approximately 0.19 ppr (within claim 13's range). (EX-1004, ¶ 148).

13. Claim 14

Claim 14 recites an article comprising a PET container with the claim 1 label disposed thereon. Schurr discloses or renders obvious such an article. (EX-1004, ¶

149). For instance, Schurr places its film in the context of wrapping "bottles, tubs or boxes," which commonly include plastic, like PET. (EX-1006, 1:6-8; EX-1004, ¶ 150). Schurr's film comprises polyester including PET components, and applying Schurr's PET-containing film to a PET container (a predominant container material) is a directly contemplated and obvious application. (EX-1004, ¶¶ 150, 152).

Alternatively, a POSITA using Schurr's recyclable film would naturally consider applying it to PET containers, a major market where recyclability is key (see discussion for [1-7]/[19-6] *supra*). (EX-1004, ¶ 151). Limitation [14-2] requires that the label be disposed on the container. Schurr discloses this, explaining the film/hose wraps "the object, for example a bottle or can" (EX-1006, 15:40-42), placing the label on the container. (EX-1004, ¶ 154). Schurr confirms orientation with Ply A "facing the object." (EX-1006, 15:64–67; EX-1004, ¶ 154).

14. Claim 15

Schurr discloses the first surface of the heat shrink film facing the container's external surface. (EX-1004, ¶ 155). Schurr describes wrapping bottles/cans (EX-1006, 15:40-43) with Ply A "facing the object." (EX-1006, 15:64-67). Because Ply A (light-blocking layer) is "adjacent" the film's "first surface" (as per [1-3]), Schurr teaches the first surface faces the container. (EX-1004, ¶ 156).

15. Claim 16

Schurr renders obvious disposing the indicia layer on the first surface. Schurr suggests printing indicia (EX-1006, 1:9-11) on the outer Ply B (second surface). (EX-1006, 7:1-4; EX-1004, ¶ 157). Disposing indicia on the first surface (i.e., reverse printing), however, is a well-known and standard alternative configuration in label manufacturing, commonly chosen to protect the indicia from scratching, scuffing, abrasion, and environmental factors. (EX-1004, ¶ 158). A POSITA would recognize reverse printing as a standard, obvious design choice for Schurr's film to achieve enhanced print protection, a clear and compelling technical motivation. (EX-1004, ¶ 158).

16. Claim 17

Schurr, in combination with the knowledge and skill of a POSITA, would find obvious the film shrinking 1-90% in the transverse direction (TD) at 100°C. (EX-1004, ¶ 159). Schurr teaches its film's "main shrinking direction is also the transverse direction." (EX-1006, 2:30-39; EX-1004, ¶ 160). Schurr discloses high shrinkage (20-85%) at 95°C. (EX-1006, Abstract; 2:26-35). A POSITA would find it obvious to test TD shrinkage at 100°C, a standard characterization. (EX-1004, ¶ 161). Given Schurr's high TD shrinkage at 95°C and intended TD orientation, a POSITA would reasonably expect substantial TD shrinkage at 100°C that would fall well within the broad 1-90% claimed range. (EX-1004, ¶ 161).

17. Claim 18

Schurr discloses or renders obvious the heat shrink film comprising crystallizable PET. (EX-1004, ¶ 162). Schurr teaches using PET (monomers: terephthalic acid, 1,2-ethanediol). (EX-1006, 2:59–3:12). Standard PET, as synthesized from these monomers, is ***inherently a semi-crystalline polymer*** and thus "crystallizable," a basic material property well-known to a POSITA. (EX-1004, ¶ 163, noting Lee, EX-1010, [0017] also describes PET's high crystallinity). Thus, by disclosing PET, Schurr necessarily discloses using a crystallizable material. (EX-1004, ¶ 163).

Furthermore, Schurr's discussion of selecting polyesters based on "crystallisation half-time" (EX-1006, 9:10–32) ***implicitly acknowledges*** that the disclosed polyesters (including PET) are capable of crystallizing, as one cannot meaningfully discuss crystallization rates for a non-crystallizable material. (EX-1004, ¶ 164). This makes it clear Schurr's PET is crystallizable. (EX-1004, ¶ 164).

18. Conclusion

As shown above, Schurr teaches or suggests nearly every limitation of claims 1-19. Any remaining elements or performance metrics not explicitly detailed would be readily achievable or confirmed by a POSITA applying ordinary skill, motivated by known needs. A POSITA would reasonably expect success applying this knowledge to Schurr's effective light-blocking, recyclable shrink film design using predictable principles and routine experimentation. Thus, claims 1-19 are obvious.

B. Ground 2: Claims 1-19 Are Obvious Over Kitano in View of Lee and the Knowledge and Skill of a POSITA[4]

Kitano discloses a multi-layer, light-shielding laminate suitable for shrink labels, comprising a PET substrate, a white ink layer, and a light-shielding layer (e.g., using aluminum particles or a mixture of TiO_2 and Carbon Black pigments). (EX-1007, Abstract, [0007], [0012], [0016], [0018], [0034], [0041]; EX-1004, ¶ 166). Lee discloses heat shrink labels using specific PET/polyester blends engineered with controlled crystallizability designed to "be supplied to the recycle steam of the PET container while being attached to the PET container," thereby avoiding problematic separation steps and addressing recycling compatibility. (EX-1010, Abstract, [0010], [0020], [0034]; EX-1004, ¶ 167).

Together, Kitano and Lee teach or suggest nearly all limitations of claims 1-19. (EX-1004, ¶ 168). Kitano provides the foundational light-blocking structure and pigment options, while Lee provides the critical technology for achieving integrated PET recycling compatibility through material design. (EX-1004, ¶ 168). Similar to Ground 1, achieving specific quantitative performance metrics (e.g., light blocking percentage over 200-900nm, shrinkage values at 100°C, coating amounts in "ppr") represents routine optimization or confirmation well within the ordinary skill of a

[4] Lee is prior art under § 102(a)(2) because Lee is a published U.S. patent application entitled to the July 21, 2020 filing date of its PCT application. (EX-1010, Cover).

POSITA building upon this combined disclosure. (EX-1004, ¶ 168). A POSITA would have been clearly motivated to combine these complementary teachings to meet known needs for light-blocking, recyclable labels, with a reasonable expectation of success. (EX-1004, ¶ 168).

1. Motivation to Combine Kitano and Lee and Reasonable Expectation of Success

A POSITA in May 2021, working in the field of packaging for PET containers, would have been well aware of two significant and concurrent technical demands that would motivate combining the teachings of Kitano and Lee. (EX-1004, ¶ 169).

First, there was the persistent need to protect light-sensitive contents from degradation. (EX-1004, ¶ 170, citing, e.g., EX-1007, [0002]; EX-1008, [0005]). Second, driven by environmental awareness, regulatory pressures (e.g., the European Green Deal (EX-1004, ¶ 172, citing EX-1011), and waste management challenges, there was strong and growing industry pressure to develop packaging components, particularly shrink labels, that were fully compatible with established PET bottle recycling streams. (EX-1004, ¶¶ 171-172, citing EX-1012, p. 1-2, 4; EX-1013, p. 5376, col. 1). This compatibility was essential for a circular PET economy and to avoid contamination of recycled PET, a concern highlighted by Lee itself (EX-1010, [0004], [0010]) and the desire for "recyclable polyester films such as [for] polyethylene terephthalate containers…" (EX-1010, [0005]; EX-1004, ¶¶ 171-172). A POSITA would have recognized that developing shrink labels addressing ***both*** needs simultaneously was a key objective. (EX-1004, ¶ 173).

Faced with this challenge, a POSITA would naturally look to available solutions. Kitano provides a well-defined solution for light shielding in a shrink label using printed layers on a substrate (e.g., metallic particles, TiO_2/Carbon Black), a standard and well-understood technique. (EX-1004, ¶¶ 174-175; EX-1007, Abstract; [0018]-[0019], [0041]). Concurrently, Lee provides a specific, targeted solution to the PET recycling compatibility problem, teaching PET/copolyester blends with controlled crystallizability to prevent issues like label fusion and enable co-recycling with PET containers. (EX-1004, ¶¶ 176-177; EX-1010, Abstract, [0004], [0010], [0020], [0034]).

Presented with Kitano's effective light-blocking system and Lee's tailored recyclable PET film substrate, a POSITA exercising ordinary skill would have found it obvious to combine these teachings, leveraging prior art elements according to their established functions, consistent with *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 417-21 (2007). (EX-1004, ¶ 178). The motivation is straightforward: to create a single shrink label incorporating both desired functionalities by replacing Kitano's generic substrate with Lee's specialized, recycling-compatible PET film, while retaining Kitano's light-shielding layers. (EX-1004, ¶¶ 179-180). This is a logical integration to improve Kitano's label with Lee's recognized benefit of recyclability, applying Kitano's known light-blocking technique to Lee's improved substrate. (EX-1004, ¶¶ 180-181). The transparency of Lee's film would not be a deterrent, as the final opacity would be determined by Kitano's light-blocking layers. (EX-1004, ¶ 183).

A POSITA would also have had a reasonable expectation of success. (EX-1004, ¶ 184). Applying ink or coating layers onto polymer films (i.e., Kitano's layers onto Lee's film) is a fundamental and routine practice. (EX-1004, ¶ 185). Both Kitano and Lee utilize PET-based chemistry, suggesting good material compatibility and adhesion, minimizing unexpected interfacial problems. (EX-1004, ¶ 186). The combined label would predictably exhibit Kitano's light-shielding and Lee's recyclability/crystallizability properties without significant negative interference. (EX-1004, ¶ 187).

Therefore, combining Kitano's light-blocking layers with Lee's recyclable PET film was obvious with a reasonable expectation of successfully producing a light-blocking, recyclable PET shrink label. (EX-1004, ¶ 188). Achieving the specific quantitative performance metrics recited in certain dependent claims would then be a matter of routine optimization and characterization. (EX-1004, ¶ 189).

2. Claims 1 and 19

Again, claims 1 and 19 cover similar recyclable, light-blocking PET shrink labels. While claim 1 requires light-blocking particulates ([1-5], [1-6]), claim 19 requires a high-opacity white pigment layer ([19-5]) in addition to a general light blocking layer. (EX-1004, ¶ 190). The combination of Kitano and Lee, with POSITA knowledge, renders both obvious. (EX-1004, ¶ 190).

a. [1-PRE], [19-PRE]

The preambles recite "[a] recyclable shrink label." To the extent they are limiting, Kitano discloses laminates for "shrink label[s]" from heat-shrinkable films. (EX-1007, Abstract; [0009]; [0028]-[0029]; [0036]). Lee explicitly discloses a "heat shrinkable label" designed to be "recyclable," stating it "can be supplied to the recycle stream of the PET container while being attached to the PET container." (EX-1010, [0010]; Abstract; [0020]). As discussed *supra* (Section VII.B.1), a POSITA motivated by PET-compatible recycling would integrate Lee's recyclable film technology into Kitano's label structure, directly resulting in a "recyclable shrink label." (EX-1004, ¶ 191).

b. [1-1]/[19-1], [1-2]/[19-2]

Kitano teaches a "heat-shrinkable stretching film" substrate, preferably PET (EX-1007, [0012], [0014], [0035]), depicting films with opposed surfaces (EX-1007, Figs. 1-5). Lee similarly discloses heat shrinkable labels using PET/polyester blends. (EX-1010, Abstract; [0010]; [0013]). The combination thus teaches a PET heat shrink film with opposed surfaces. (EX-1004, ¶ 193).

Regarding thickness, Kitano teaches a 5-90µm range (preferably 9-70 µm), using 30µm in an example. (EX-1007, [0014], [0035]). Lee also discloses overlapping thicknesses, specifically 3µm to 350µm. (EX-1010, [0098]). These overlapping ranges establish prima facie obviousness for the claimed 15-100µm range. *DuPont*, 904 F.3d at 1006. (EX-1004, ¶ 194). Moreover, the claimed 15-100µm range represents a ***standard, conventional range*** for such films. (EX-1004, ¶ 195). A POSITA would routinely select a thickness within this conventional range (consistent with Kitano's preferred range and Lee's disclosure) based on standard factors like strength, flexibility, and cost, making the claimed range an obvious design choice without unexpected results. (EX-1004, ¶¶ 195-196).

c. [1-3]/[19-3]

Kitano discloses a "light shielding layer" (layer 3) comprising "light shielding ink containing … aluminum particles" (a light blocking component). (EX-1007, [0007]-[0008], [0018]; EX-1004, ¶ 199). Kitano shows this layer printed on another layer (2, white ink) on the substrate (1). (EX-1007, Fig. 1, [0011]). This light shielding layer is "adjacent" the first surface (container-facing surface of the substrate) under the '422 Patent's definition (EX-1001, 6:51-57). (EX-1004, ¶ 199).

d. [1-4]/[19-4]

Kitano teaches "excellent light shielding properties" (EX-1007, [0019]) and targets low transmittance (EX-1007, [0020]), using materials (Al particles,

TiO_2/Carbon Black (EX-1007, [0018], [0034], [0041])) known by a POSITA to provide broad UV-Vis-NIR attenuation (200-900nm). (EX-1004, ¶¶ 201-202).

Achieving the specific ≥80% blocking over 200nm—900nm was obvious. (EX-1004, ¶ 200). Motivated to combine Kitano's light blocking with Lee's recyclability, a POSITA would recognize that blocking percentage is a predictable function of known variables: choice, concentration, and thickness of Kitano's light-blocking component. (EX-1004, ¶ 203; *In re Boesch*, 617 F.2d 272, 276 (CCPA 1980)). Optimizing these standard parameters via routine experimentation or calculation to meet a quantitative target (≥80% over 200-900nm) is within ordinary skill and would not yield unexpected results. (EX-1004, ¶¶ 203-204; *KSR*, 550 U.S. at 417).

e. [1-5]

Kitano discloses "flaked aluminum particles" with an "average particle size of 7 µm," (EX-1007, [0034]), which is squarely within the claimed 0.1-100µm range and thus expressly teaches this limitation. (EX-1004, ¶ 207).

f. [1-6]

Kitano discloses aluminum particles ("metal," "reflective pigment") (EX-1007, [0018], [0034]) and alternatively a mixture of TiO_2 ("metal oxide") and carbon black (EX-1007, [0041]). Kitano therefore teaches multiple species within the claimed "metal, metal oxide, a reflective pigment, carbon black, mica, or a combination thereof." (EX-1004, ¶ 209).

g. [19-5]

Kitano explicitly discloses adding a "shielding layer" (EX-1007, layer 2 in Fig. 1) composed of "white ink" (EX-1007, [0011]), which conventionally contains a "white pigment," such as the preferred titanium dioxide (TiO_2) (EX-1007, [0016]). This layer serves to provide opacity and a white background. (EX-1007, [0011], [0015]). This white ink shielding layer directly corresponds to the claimed "high opacity layer comprising a white pigment." (EX-1004, ¶ 211).

h. [1-7]/[19-6]

The combination of Kitano and Lee teaches or renders obvious a label "recyclable with a PET container." (EX-1004, ¶ 212). While Kitano applies its label to a PET bottle (EX-1007, [0037]) and primarily discusses separability as an advantage (EX-1007, [0009]), Lee's *core teaching* is a PET-based shrink film specifically formulated such that the label "can be reused while attached to a PET container" (EX-1010, [0010]) and successfully processed within standard PET recycling streams ([0020]). (EX-1004, ¶ 215). A POSITA, motivated to create a label meeting known industry demands for PET recycling compatibility (as discussed in Section VII.B.1, *supra*), would incorporate Lee's explicit teaching of an engineered, recyclable film substrate into Kitano's label structure. (EX-1004, ¶ 215). Lee thus provides the explicit disclosure for achieving integrated recyclability of the PET film base required by these limitations. (EX-1004, ¶ 215). Combining Kitano's printed light-shielding layers with Lee's recyclable film technology, therefore, directly teaches or renders obvious a label that is "recyclable with a PET container." (EX-1004, ¶ 215).

Furthermore, even before considering Lee, a POSITA would recognize Kitano's label as potentially compatible with integrated PET recycling. Kitano uses similar materials and configurations to the claimed invention—a PET film and a separate, light blocking layer adjacent to the PET film. (EX-1004, ¶ 213). Kitano expressly describes, "The light shielding layer may be formed by printing on an entire surface solid or partial coat as necessary by a conventional printing method such as gravure printing, offset printing, or silkscreen printing, and even one layer may be formed by overlapping two or more layers." (EX-1007, [0018]). This is the same type of printing described in the '422 Patent for its light blocking composition. ('422 Patent, 14:37-55). Accordingly, a POSITA would expect similar recyclability capabilities between the labels described in Kitano and the claimed labels. (EX-1004, ¶ 213).

Patent Owner's prosecution arguments—that light blocking materials ***embedded*** in PET film render it unrecyclable by caustic wash (see Section IV.C, *supra*)—are misplaced when applied to Kitano's structure. Kitano teaches applying its light-shielding layer (e.g., aluminum particles or TiO_2/Carbon Black in a binder) as a ***printed layer*** on the substrate. (EX-1007, Abstract, [0007]-[0008], [0018]; EX-1004, ¶ 214). This is fundamentally different from pigments compounded directly into the polymer matrix of the heat shrink film itself. (EX-1004, ¶ 214). A POSITA would understand that such distinct printed layers are more amenable to removal or management during recycling processes, including caustic wash, than integrally pigmented films, especially if inks are designed for removability—a known objective for recyclable labels. (EX-1004, ¶ 214, citing EX-1012, p.4). Moreover, the art before the '422 patent's effective filing date, such as Ügdüler (EX-1013), demonstrated that PET with additives like carbon black could be successfully recycled using optimized alkaline hydrolysis (tertiary recycling) to remove such additives. (EX-1004, ¶ 214, citing EX-1013, Abstract). PO's assertion that pigments in the heat shrink film inherently ruin recyclability is thus unsupported when considering Kitano's printed layer construction and the knowledge of a POSITA.

3. Claim 2

Kitano explicitly discloses incorporating indicia layers into its light-shielding laminate structure. (EX-1004, ¶ 217). Specifically, Kitano teaches that "a pattern printing layer 4 may be provided between the substrate layer 1 and the shielding layer 2," or alternatively, "a pattern printing layer 6 may be provided on an opposite side (outer surface side)." (EX-1007, [0011], Figs. 2-3). These pattern printing layers, composed of printing ink and depicting items like characters or figures (EX-1007, [0023]), inherently function as the claimed "indicia layer." (EX-1004, ¶ 217). While Lee focuses on film recyclability, its "heat shrinkable label" (EX-1010, [0010]) would typically include indicia. (EX-1004, ¶ 217). Adding this standard and nearly universal feature, explicitly taught by Kitano, to the obvious base structure from Kitano and Lee would be straightforward, rendering claim 2 obvious. (EX-1004, ¶ 218).

4. Claim 3

Kitano and Lee render claim 3 obvious because Kitano discloses a high opacity layer comprising a white pigment, as discussed *supra* at Section VII.B.2.g for limitation [19-5]. (EX-1004, ¶¶ 219-221). Kitano's "shielding layer" made from "white ink" containing a "white pigment" (e.g., TiO_2) provides opacity and a white background, directly corresponding to this limitation. (EX-1007, [0011], [0015], [0016]; EX-1004, ¶ 220). Incorporating this feature, expressly taught by Kitano, is an obvious element if opacity is desired. (EX-1004, ¶ 221).

5. Claim 4

Kitano's embodiment shown in Figure 2 explicitly discloses the claimed arrangement where the high opacity layer is between the indicia and light blocking layers. (EX-1004, ¶¶ 222, 224). In Figure 2, Kitano depicts a substrate layer (1), upon which an indicia ("pattern printing") layer (4) is back-printed. (EX-1007,

[0011], Fig. 2). Printed over the indicia layer (4) is the white ink "shielding layer" (2) (the claimed high opacity layer). (EX-1007, [0011], Fig. 2). Finally, Kitano teaches printing the light shielding layer (3) (the claimed light blocking layer) onto the shielding layer (2). (EX-1007, [0011], [0018]). This specific configuration shown by Kitano places the high opacity layer (2) directly between the indicia layer (4) and the light blocking layer (3). (EX-1004, ¶ 224). Adopting this explicitly disclosed arrangement in the combined Kitano/Lee structure is an obvious design choice. (EX-1004, ¶ 225).

6. Claim 5

Kitano renders obvious a heat shrink film that consists of PET. (EX-1004, ¶ 226). Kitano identifies various resins suitable for its substrate layer, and states that PET film is preferable when back printing is applied due to its high transparency. (EX-1007, [0012], [0014]). Kitano clarifies how these resins may be employed: "These ***may be used alone***, two or more resins may be blended, or a multilayer film [...] may also be used." (EX-1007, [0012], emphasis added; EX-1004, ¶ 227). Kitano thus explicitly teaches the option of using PET ***alone*** as the substrate layer, directly corresponding to a heat shrink film that "consists of" PET (in terms of its polymeric component). (EX-1004, ¶ 228).

Furthermore, Kitano's working examples utilize standard commercial PET films as the substrate, e.g., a 30μm PET film in Example 1 (EX-1007, [0035]) and a

12μm PET film in Example 2 (EX-1007, [0039]), reinforcing the disclosure of using PET as the primary or sole polymer component. (EX-1004, ¶ 228).

Accordingly, it would be obvious for a POSITA to select a heat shrink film consisting solely of PET as taught by Kitano, particularly when also considering Lee's teachings on PET for recyclability. (EX-1004, ¶ 230).

7. Claim 6

Kitano explicitly describes and depicts forming its light shielding shrink film into a "cylindrical shrink label," stating that this label "may be in the form of a tube." (EX-1007, [0028], Fig. 6). This cylindrical tube form is synonymous with the claimed "sleeve or tube." (EX-1004, ¶ 231). Lee also refers to its invention providing a "heat shrinkable label" (EX-1010, [0010]), a term commonly including sleeve labels. (EX-1004, ¶ 231). Thus, the combination includes this feature. (EX-1004, ¶ 232).

8. Claim 7

Kitano teaches forming its "cylindrical shrink label" by overlapping end portions and bonding them "via thermal bonding or adhesive, or a seal portion may be formed by a solvent seal." (EX-1007, [0028], Fig. 6; EX-1004, ¶ 234). Example 1 implements this using a solvent seal on overlapped portions to form a cylinder. (EX-1007, [0036]). This process of overlapping and bonding edges to create a tube ***inherently and necessarily*** results in a seam where the edges meet and are joined, rendering claim 7 obvious. (EX-1004, ¶¶ 234-235).

9. Claim 8

Both Kitano and Lee disclose heat-shrinkable PET-based films exhibiting significant shrinkage upon heating, rendering claim 8 obvious. (EX-1004, ¶ 237). Kitano shows 62% shrinkage at 90°C and discusses films with potential TD shrinkage up to 90%. (EX-1007, [0013], [0035]). Lee teaches "excellent shrinkage," citing maximum values up to 75%+ at 95°C. (EX-1010, [0010], [0079]). (EX-1004, ¶ 237).

While neither provides shrinkage data observed precisely at 100°C, a POSITA would understand shrinkage is temperature-dependent and PET films shrinking significantly at 90-95°C would also shrink substantially, often slightly more, at the common shrink temperature of 100°C. (EX-1004, ¶¶ 238-239). Characterizing shrinkage at 100°C is a routine laboratory procedure. (EX-1004, ¶¶ 240-241). The claimed "about 1% to about 90%" range is ***exceptionally broad***, encompassing virtually all relevant commercial shrinkage levels. (EX-1004, ¶ 242). Based on Kitano's and Lee's disclosed values near 100°C, a POSITA would reasonably expect shrinkage at 100°C to predictably fall well within this expansive 1-90% range, without unexpected results. (EX-1004, ¶ 242; *KSR*, 550 U.S. at 417; *In re Boesch*, 617 F.2d at 276.

10. Claim 9

Claim 9 differs from claim 8 by specifying that the ***entire label*** shrinks within the 1-90% range at 100°C. (EX-1004, ¶ 245). As established for claim 8, a POSITA would expect the heat shrink film itself (from Kitano/Lee) to shrink within the 1-90% range at 100°C. (EX-1004, ¶¶ 246-247).

Kitano teaches applying its functional layers (white ink shielding layer, light shielding layer, etc.) onto this heat shrink film substrate and shrinking the composite label. (EX-1007, [0011], [0018], [0024], [0035]-[0037]; EX-1004, ¶ 248). A POSITA would understand that these thin ink and coating layers (e.g., Kitano Example 1: 30μm substrate vs. 2μm white layer, 0.3μm Al layer (EX-1007, [0035]-[0036])) are designed to adhere to the substrate and conform to its dimensional changes during shrinkage, without substantially impeding the film's inherent shrinkage. (EX-1004, ¶¶ 249-250). Therefore, the shrinkage of the "entire recyclable shrink label" is dominated by, and substantially corresponds to, the shrinkage of the base heat shrink film. (EX-1004, ¶ 250). Because the base film's shrinkage at 100°C would be within the 1-90% range, the "entire recyclable shrink label" would also shrink within the same broad 1-90% range at 100°C, rendering claim 9 obvious. (EX-1004, ¶ 251).

11. Claim 10

Kitano teaches a high opacity layer as its "shielding layer" made from "white ink." (EX-1007, [0011], [0016]; EX-1004, ¶ 253). Kitano explicitly teaches using "conventional white ink … in which a white pigment is added" and lists suitable examples: "titanium oxide, calcium carbonate, magnesium carbonate, and mixtures … but titanium oxide ... is preferably used." (EX-1007, [0016]; EX-1004, ¶ 254). Kitano's disclosure of titanium dioxide (TiO_2) and calcium carbonate (which includes common forms like PCC) explicitly teaches species falling within the claimed group. (EX-1004, ¶ 254). Since Kitano explicitly teaches using preferred TiO_2 or calcium carbonate as the white pigment in its high opacity layer, and this layer is part of the combined Kitano/Lee structure, claim 10 would have been obvious based on Kitano's direct disclosure. (EX-1004, ¶ 255).

12. Claim 11

Kitano explicitly discloses components falling within the claimed group, rendering claim 11 obvious. (EX-1004, ¶ 256). Kitano's light blocking component includes "aluminum particles," which meets the "metal" and "reflective pigment" elements recited in the claim. (EX-1007, [0018]-[0019], [0034]; EX-1004, ¶ 258). Kitano also discloses using a gray ink containing "titanium dioxide" (a "metal oxide") and "carbon black" (EX-1007, [0041]), also recited in the group. (EX-1004, ¶ 258). Because Kitano explicitly teaches using aluminum, TiO_2, and carbon black as light blocking components falling within the recited group, claim 11 would have been obvious from Kitano's teachings. (EX-1004, ¶ 259).

13. Claim 12

Claim 12 requires that the light blocking layer be "present in an amount of 0.5 ppr to 25 ppr relative to the recyclable shrink label." This is rendered obvious by Kitano in view of Lee and POSITA knowledge. (EX-1004, ¶ 260). Claim 1 requires a light blocking layer ([1-3]) achieving specific light blocking performance ([1-4]). Kitano teaches this layer (e.g., layer 3) using materials like aluminum paste and provides exemplary thicknesses (e.g., 0.3μm in Example 1; range 0.1-10μm). (EX-1007, [0035], [0021], [0034]; EX-1004, ¶ 261).

As discussed above (Section VII.B.2.d), achieving the target light blocking performance involves routine optimization of the layer's parameters, including applying the appropriate amount of light blocking component, which is a function of ink formulation and applied thickness. (EX-1004, ¶ 262). "Ppr" is a standard unit, and conversion from thickness/concentration is a routine calculation for a POSITA. (EX-1004, ¶ 263). A POSITA, performing routine optimization of Kitano's taught materials to achieve the ≥80% blocking, would predictably arrive at a coating weight for the light blocking layer within the *broad* 0.5-25 ppr range, which encompasses typical functional layer weights. (EX-1004, ¶¶ 264-265). Dr. Storey notes that while his direct calculation for Kitano's 0.3μm layer is ~0.24 ppr, minor, routine adjustments in thickness or formulation to ensure robust ≥80% blocking would easily result in a ppr value within the claimed range. (EX-1004, ¶ 265). No unexpected results are associated with this range. (EX-1004, ¶ 266; *Cf. Galderma Labs., L.P. v. Tolmar, Inc.*, 737 F.3d 731, 738 (Fed. Cir. 2013)). Based on Kitano's layer teaching, combined with routine optimization to meet claim 1 performance using standard industry units, claim 12 would have been obvious. (EX-1004, ¶ 267).

14. Claim 13

This claim specifies the ppr amount (0.1-10 ppr) of the light blocking *component itself* within the light blocking layer and is also obvious. (EX-1004, ¶ 268). As established for claim 12, a POSITA would determine the total ppr amount of the light blocking layer needed to meet claim 1's performance criteria ([1-4]) via routine optimization. (EX-1004, ¶ 269). Kitano teaches component concentrations within its inks. For example, its silver ink used an aluminum paste with "about 10% by mass" aluminum particles, which constituted 10% mass of the final ink. (EX-1007, [0034]; EX-1004, ¶ 270). Similarly, a gray ink used a "mixed pigment composed of titanium dioxide and carbon black." (EX-1007, [0041]).

A POSITA, having determined the total layer ppr (claim 12), would know the component concentration from the ink formulation (guided by Kitano) and could perform the ***straightforward calculation*** to find the component ppr. (EX-1004, ¶¶ 271-272). The claimed 0.1-10 ppr component range is broad and typical for active materials in such layers. (EX-1004, ¶ 273). Achieving claim 1's required performance using Kitano's materials would predictably result in a component amount within this conventional range. (EX-1004, ¶¶ 273-274). For instance, Dr. Storey notes that an optimized layer from Kitano's Example 1 (e.g., 1 ppr total layer) with typical aluminum particle loading (10-50 wt%) would clearly result in component ppr within claim 13's range. (EX-1004, ¶ 274). No unexpected results are associated with this range. (EX-1004, ¶ 275). Therefore, based on Kitano's component/concentration teachings and routine optimization/calculation to meet claim 1 performance, claim 13 would have been obvious. (EX-1004, ¶ 276).

15. Claim 14

a. [14-PRE] and [14-1]

Kitano explicitly describes applying its label to a "PET bottle," and shrinking it onto the "outer surface of this PET bottle." (EX-1007, [0037]; EX-1004, ¶ 278). A PET bottle comprises PET and has an external surface. (EX-1004, ¶ 278). Lee also focuses on labels for "PET container[s]." (EX-1010, [0010], [0099]; EX-1004, ¶ 279). The combination clearly teaches the claimed article comprising a PET container, rendering these limitations obvious. (EX-1004, ¶ 281).

b. [14-2]

As noted, Kitano explicitly teaches applying its shrink label onto the PET bottle's outer surface. (EX-1007, [0037]). Lee teaches that its label is designed to be "supplied to the recycle stream … while being attached to the PET container." (EX-1010, [0010], [0020]). The combined label is thus explicitly taught or strongly suggested by Kitano and Lee as being disposed on the PET container, rendering this limitation obvious. (EX-1004, ¶¶ 280-281).

16. Claim 15

Claim 15 requires the "first surface of the heat shrink film faces the external surface of the container." Kitano describes its laminate structure configured with the "substrate layer (outermost layer)" and functional layers as the "(innermost layer.)" (EX-1007, [0028], Fig. 6; EX-1004, ¶ 283). This places the film's first surface (carrying the functional layers) innermost, facing the container. (EX-1004, ¶ 283). Kitano's Example 1 also uses "back printed" layers (EX-1007, [0035]), implying the same orientation which protects the printed layers, a standard industry practice. (EX-1004, ¶¶ 284-285). Kitano thus describes this configuration, rendering claim 15 obvious. (EX-1004, ¶ 285).

17. Claim 16

As established above, Kitano teaches an indicia ("pattern printing") layer and Figure 2 shows the recited configuration where the indicia layer is disposed on the first surface. (EX-1004, ¶¶ 287-288). Kitano states: "As illustrated in FIG. 2, a pattern printing layer 4 may be provided between the substrate layer 1 and the shielding layer 2, wherein printing ink is back printed on the substrate layer 1." (EX-1007, [0011], Fig. 2). "Back printing" inherently means printing on the surface that becomes the inside ("first surface") when applied to a container. (EX-1004, ¶ 288).

Kitano's Figure 2 thus ***explicitly discloses*** disposing the indicia layer (4) on the first surface of the film (1), rendering claim 16 obvious. (EX-1004, ¶¶ 288-289).

18. Claim 17

As established for claim 8, the combined label's film would predictably shrink within 1-90% at 100°C. Claim 17 requires that this shrinkage be in the transverse direction (TD), which is the expected primary shrinkage direction for sleeve labels. (EX-1004, ¶¶ 290-292). Kitano explicitly discusses adjusting the heat shrinkage factor "in the TD direction," targeting 50-90% (at 90°C). (EX-1007, [0013]; EX-1004, ¶ 292). Kitano's Example 1 film (62% shrinkage at 90°C (EX-1007, [0035])), used for a cylindrical label shrunk onto a bottle (EX-1007, [0028], [0037]), implies TD shrinkage for circumferential conformance. (EX-1004, ¶ 292). Lee also discloses films for shrink labels (EX-1010, [0010]), conventionally oriented for TD shrinkage. (EX-1004, ¶ 293).

A POSITA combining Kitano's structure with Lee's film would expect the significant shrinkage (established for claim 8 as 1-90% at 100°C via routine testing, see Section VII.B.9, *supra*) to occur primarily in the TD, consistent with Kitano's teachings and standard practice. (EX-1004, ¶ 294). Achieving 1-90% TD shrinkage at 100°C is thus rendered obvious. (EX-1004, ¶ 294).

19. Claim 18

The film of Kitano comprises PET (EX-1007, [0014]) as does the film of Lee

(EX-1010, [0010]). Claim 18 requires that this PET be "crystallizable." Standard PET (used by Kitano) is ***inherently crystallizable***. (EX-1004, ¶ 297). Lee provides the explicit context and motivation for controlling PET's crystallizability for recycling, teaching PET blends formulated considering recycled PET's crystallization temperature (EX-1010, [0034]) and controlling crystallization rate for compatibility ([0020]) to avoid problems like fusion ([0020]). (EX-1004, ¶ 298). Lee's film thus explicitly comprises PET designed to be "crystallizable," relevant for recycling. (EX-1004, ¶ 299).

A POSITA motivated to combine Kitano's label with Lee's technology for integrated recyclability would incorporate Lee's teaching of using PET blends with the appropriate crystallizable nature for co-recycling. (EX-1004, ¶ 300). Lee directly teaches using PET formulations where crystallizability is controlled for recyclability. Incorporating Lee's teachings inherently results in a film comprising crystallizable PET, rendering claim 18 obvious. (EX-1004, ¶ 300).

20. Conclusion

For these reasons, claims 1-19 are obvious over Kitano in view of Lee and the knowledge and skill of a POSITA.

IX. CONCLUSION

For the foregoing reasons, Petitioner respectfully requests that the Board institute IPR and cancel the Challenged Claims.

Dated: June 24, 2025

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CERTIFICATE OF LENGTH (37 C.F.R. §§ 42.24(d))

The undersigned certifies that, according to the word-processing system used to prepare the foregoing document, this document has 13,569 words, excluding the parts exempted by 37 C.F.R. §§ 42.24(a)(1), and thus complies with the applicable word limit.

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CERTIFICATE OF SERVICE (37 C.F.R. §§ 42.6(e), 42.105(a))

The undersigned certifies that, on June 24, 2025, a complete and entire copy of the foregoing document, including all exhibits, was provided via Federal Express to the Patent Owner by serving the correspondence address of record for the '422 patent:

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CERTIFICATION PURSUANT TO 37 C.F.R. § 42.11

The undersigned certifies that the foregoing document and accompanying evidence are not being presented for an improper purpose and that all legal contentions, allegations, and denials are warranted and have evidentiary support.

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