

Patent No. 6,455,138  
Petition For *Inter Partes* Review

**UNITED STATES PATENT AND TRADEMARK OFFICE**

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**BEFORE THE PATENT TRIAL AND APPEAL BOARD**

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Wavelock Advanced Technology Co., Ltd.,  
Petitioner

v.

Textron Innovations Inc.  
Patent Owner

Patent No. 6,455,138  
Issue Date: September 24, 2002  
Title: METALLIZED SHEETING, COMPOSITES,  
AND METHODS FOR THEIR FORMATION

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*Inter Partes* Review No. \_\_\_\_\_

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**DECLARATION OF ROBERT IEZZI, Ph.D.**

## **I. INTRODUCTION**

1. I have been retained by Morrison & Foerster LLP in this case as an expert in the relevant art.

2. I have been asked to provide my opinions and views on the materials I have reviewed in this case related to U.S. Patent No. 6,455,138 (the '138 patent), and the scientific and technical knowledge regarding the same subject matter as the '138 patent before and at the earliest effective filing date of December 31, 1997. The '138 patent issued from US Application Serial No. 09/223,545 (the '545 application), which was filed on December 30, 1998. The '138 patent also claims priority to US Provisional Application Serial No, 60/070,166 (the '166 application), which was filed on December 31, 1997, and is the earliest effective filing date of the '138 patent.

3. My opinions and underlying reasoning for the opinions are set forth below.

## **II. PROFESSIONAL BACKGROUND**

4. I have been active in industries related to the relevant field of art of thermoplastic composites and laminate films for approximately 40 years. I am presently Vice President of Coating Technologies at NEI Corporation in Somerset, NJ. In this capacity, I am responsible for new product development of novel polymer coatings and films based on nano-materials. I am also the Founder and

CEO of RAI Technical Solutions®, Inc. In this capacity, I provide consulting on corrosion, coatings, polymers, and nano-composites. Prior to this, I was Manager of the Coating Research Group at Arkema Chemicals Research Center, King of Prussia, PA (1994-2002) where I was responsible for the new product development and technical service of polyamide and fluoropolymer films and coatings. At the same company, I was Manager of the Plastic Additives Research Group (2002-2006) with responsibility for new product development of novel additives for plastic products. Prior to that (1989-1994), I was Section Head of Metals & Plastics Coatings Research at Betz Laboratories, Trevose, PA. From 1985-1989, I was the Director of Packaging Technology at Campbell Soup Company in Camden, NJ. From 1965 to 1985, I worked on metal and paint coatings at Republic Steel and Bethlehem Steel. All the positions described above relate to work with coatings, including polymer films, metallization, and adhesives.

5. I was also an Adjunct Professor of Engineering at Pennsylvania State University, Great Valley Campus from 2006 to 2010. In this part-time position, I taught graduate level engineering courses in innovation and creativity, along with an MBA course in New Business Ventures and Entrepreneurship.

6. I earned a B.S. in Chemical Engineering from Widener University in 1965. I earned a M.S. in Physics from Kent State University in 1969. I also earned a Ph.D. in Materials Science from Lehigh University in 1979.

7. Most of my research has focused on polymer composite materials, and metal and organic coatings applied to metals and plastic composites, including chemical vapor deposition. As far as applications, I have over 40 years of experience with the automotive industry, mainly in metal and plastic auto body materials and coatings. More specifically, I have worked on: (a) chemical vapor deposition of metal coatings on steel for use on autobody parts; (b) polymer composite films for use on plastic autobody parts; (c) nylon coatings for automotive under-hood applications and guide rails for sliding minivan doors; (d) impact modifiers for polycarbonate body panels; and (e) automotive thermoplastic olefins.

8. My research has resulted in over 50 publications and presentations of papers. I am an inventor on six issued U.S. patents, and two pending patent applications.

9. I am a member of the American Chemical Society, the American Coatings Association, and the Federated Societies of Coatings Technology. I was previously on the Board of Directors of the National Coil Coating Association, and the Delaware Valley Volunteers of America. I was also a member of the American Society for Materials, and the Society of Plastic Engineers.

10. I am recipient of the following awards: (a) Packing Institute International Annual Education Award (best paper); (b) National Association of

Corrosion Engineers Romanoff Award (best paper); (c) National Coil Coating Association Technical Section Certificate of Appreciation; and (d) chosen to participate in the Industrial Research Institute Visiting Scientist Program.

11. A copy of my curriculum vitae that summarizes my education, work history and publications is in Appendix A.

12. I am being compensated for taking part in this case but have no other relationship to Wavelock Advanced Technology Co., Ltd. My compensation is not dependent on the outcome of this case.

### **III. BASIS FOR OPINION**

13. My opinions and views set forth in this report are based on my education, training, and experience in the relevant field, as well as the materials I reviewed in this case, and the scientific knowledge regarding the same subject matter that existed prior to the earliest effective filing date of the '138 patent.

### **IV. PATENT LAW STANDARD**

14. It is my understanding that a patent claim is invalid for anticipation if it can be shown that each and every limitation of the claim is disclosed either expressly or inherently in a single prior art reference. It is also my understanding that to establish anticipation by inherency, the extrinsic evidence must be clearly described in the reference.

15. It is my understanding that a patent claim is invalid for obviousness if the claimed invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made, in view of a single prior art reference or a combination of prior art references. Specifically, I understand that a determination of whether a claimed invention would have been obvious requires taking into consideration factors which include: (a) assessing the scope and content of the prior art; (b) the differences between the claimed invention and the prior art; and (c) the level of ordinary skill in the art. I further understand that secondary considerations, such as commercial success, the solution of long-recognized but unresolved needs, failures of others, etc. may be considered in a determination of obviousness.

16. It is my understanding that when combining two or more references, or when modifying an item disclosed in one reference, so as to arrive at a claimed invention, one should consider whether there is a reason for the proposed combination or modification. For example, when a technology or product is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. For the same reason, if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in

the same way, using the technique is obvious unless its actual application is beyond his or her skill.

17. It is my understanding that the claims of a patent are analyzed from the perspective of “a person of ordinary skill in the art” and that the claims of the ’138 patent are interpreted as a person of ordinary skill in the art would have understood them at the time the ’545 application, which issued as the ’138 patent, was filed.

18. It is my understanding that “prior art” includes patents and publications in the relevant literature and information that predates the effective filing date of the ’138 patent, December 31, 1997. It is also my understanding that a patent application can describe prior technologies as prior art in his specification, and the admitted prior information can be used as “prior art” against his claims.

## **V. A PERSON OF ORDINARY SKILL IN THE ART**

19. A person of ordinary skill in the art relevant to the ’138 patent would have had at least a bachelor’s degree in chemical engineering, material science, or chemistry, and at least five years of experience working with or researching thermoplastic films and composites.

## **VI. OVERVIEW OF THE APPLICABLE TECHNOLOGIES**

20. Following is an overview of the applicable technologies and the state of the art before and at the earliest effective filing date of the application that

issued as the '138 patent. The '138 patent issued from US application Serial No. 09/223,545 (“the '545 application”), which was filed on December 30, 1998. The '138 patent also claims priority to US Provisional application Serial No. 60/070,166 (“the '166 application”), which was filed on December 31, 1997, and is the earliest effective filing date of the '138 patent.

21. The '138 patent generally relates to metallized thermoplastic composites. These metallized composites can be used as reflective surfaces, for example, as mirrors or as substitutes for decorative chrome parts. For example, these metallized composites can be used for decorative trim used on the bumpers and bodies of automobiles as well as interior reflective trim parts.

22. In the late 1970s, the automotive industry started replacing conventional decorative trim made of metals, such as chrome, with decorative trim made of plastic composites including thermoplastic layers and a metal layer deposited on one of the thermoplastic layers. Examples of the thermoplastic materials of the composites are polyesters, polycarbonates, and vinyl polymers. As specific example, polyurethane terephthalate (PET) and acrylonitrile-butadiene-styrene (ABS) were used for the thermoplastic layers. *See*, for example, U.S. Patent No. 4,403,004 (Parker), col. 4:33-42. The plastic composites offered better alternates to conventional all-metal parts because they were light and inexpensive. When creating a metallized film, a base layer is typically metallized. A second



polymer layer was then applied over the metallized layer to protect the metal from the elements and corrosion. The second polymer layer could be applied directly to the metallized layer; however, often times an adhesive layer was applied prior to the second polymer layer to improve adhesion of the second polymer layer and further improve corrosion and delamination characteristics of the composite. *See*, for example, Parker, col. 5:58-60. For metallization, aluminum and chrome were used at the beginning of this technology. However, prior to the filing of the '545 application, a wide variety of metals were used for metallization including aluminum, chromium, tin, indium and iron. *See*, for example, U.S. Patent No. 4,101,698 (Dunning), col. 2:6-13.

23. As stated in the Background of the Invention portion of the '138 patent, before the filing of the '545 application, it was known that, in order to provide reflectivity suitable for automotive trim, the metal layer in the composite does not have to be continuous. Therefore, a discontinuous film can be used to provide a surface that has better corrosion resistance than metallized films with continuous metal surfaces. A discontinuous metal layer resists corrosion because, even if corrosion starts, it does not propagate to neighboring portions of metal layer due to the separations of the metal islands. It was also known that a discontinuous metal layer promotes better attachment between two thermoplastic layers sandwiching the metal layer, which also contributes to corrosion resistance

by reducing possibility of delamination. *See*, for example, the '138 patent, col. 1:24-32.

24. It was well known at the time that the '545 application was filed that metal layers could be deposited on a thermoplastic layer using a variety of deposition techniques, such as evaporation and sputtering. These deposition processes include continuous processes in which a web of plastic film is unrolled and fed into a deposition chamber. *See*, for example, Parker, col. 8:21-50, and FIG. 2.

25. During a metal deposition process, deposition begins at small nucleation sites on the polymer film. Small islands of the metal are formed on the plastic film at these nucleation sites. The typical size of the metal islands is as small as 100 Å. Once the metals islands are formed, the islands continue to grow to fill the gaps between the islands and thus to form a continuous film. It was known that a discontinuous metal layer could be formed by stopping the deposition process before the islands grow together. *See*, for example, U.S. Patent No. 4,407,871 (Eisfeller), col. 5:206.

26. It was also understood that it is easier to form metallized layers, and discontinuous metal layers in particular, using low-melting-point metals. *See*, for example, Translation of Japanese Patent Application Publication No. S63-286337 (Kuwahara), at 4:17-27. These metals all have melting points below 500°C.

Examples of such metals are tin, lead, bismuth, zinc and indium. It was known that it is easy to control the nucleation and growth of a metal with a low melting point. Further, higher melting point metals can damage or destroy the polymer base layer because of the high temperatures required to deposit these metals. It was also known that various types of adhesives could be used to attach a metallized thermoplastic layer to another thermoplastic layer. These adhesives included polyester, polyamides, silicone and polyurethane adhesives. *See*, for example, U.S. Patent No. 5,532,045 (Wade), col. 5:59-63, and Parker, col. 6:1-4. Since the adhesives are made of materials similar to the thermoplastic layers, they adhere well to the thermoplastic layers. The adhesion between a metal layer and an adhesive is essentially determined by bonding between the adhesive and hydroxyl groups formed on the oxidized surface of the metal layer. For this reason, it was known that adhesives that adhere well to one type of metallized surface would typically adhere well to other metallized surfaces.

## **VII. THE '138 PATENT**

27. The '138 patent includes only one independent claim, claim 1, which recites:

1. A metallized composite, comprising:
  - a) a first thermoplastic layer;
  - b) a discontinuous layer on said first layer, said discontinuous layer including discrete islands of metal in an adhesive; and

c) a second thermoplastic layer, said discontinuous layer being between said first and second thermoplastic layers.

28. Dependent claims 2 and 33-36 add structural features of the metallized composite, dependent claims 3, 8, 10, 31 and 32 define chemical features of the thermoplastic layers, dependent claims 16-19 and 21 define chemical features of the adhesive, dependent claims 25-27 define chemical features of the metal, and dependent claims 27-30 add coloring features of the composite, to the respective parent claims.

#### The Specification of the '138

29. The '138 patent issued from the '545 application, which was filed on December 30, 1998. The '545 application claims priority to U.S. provisional Application No. 60/070,166, which was filed on December 31, 1997. Col. 1:5-7. In the Background of the Invention section of the '138 patent, the applicant states that existing composites having two polymer sheets and a continuous metal layer disposed between the two sheets, which are used as a substitute for automotive decorative chrome parts, have delamination and corrosion problems. Col. 1:15-23. The Background of the Invention section also acknowledges that a known solution to the delamination and corrosion problems was to make the metal layer discontinuous. Col 1:23-32. However, in the Background of the Invention, the '138 patent states that *in situ* polymerization of a top coat layer may not result in a

strong bonding between the top layer and the underneath layers. According to the '138 patent, it was known that the bonding problem could be improved by etching the metal layer prior to the *in situ* polymerization, but the etching leads to blackening of the metal layer. Col. 1:33-60.

30. Accordingly, the '138 patent describes two structures to address these problems with laminate composites that include a discontinuous layer: 1) a laminate that includes two thermoplastic layers and a discontinuous metal layer of discrete metal islands in an adhesive that is placed between the two thermoplastic layers (shown in FIG. 1); and 2) a continuous thermoplastic sheet that includes a discontinuous metal layer in the sheet (shown in FIG. 2). Col. 2:6-16.

31. The metals described in the '138 patent for metallization were conventional metals that were used for thin film deposition, including aluminum and indium. Col. 4:11-14. Similarly, the '138 patent provides a list of known adhesives that were used for laminating thermoplastic layers. Col. 4:19-35. The '138 patent also states that many of conventional thermoplastic materials can be used as the materials for the thermoplastic layers in the composite. Col. 4:26-67. The metallized composites can be colored using conventional coloring techniques known at the time. Col. 5:8-21. The '138 patent also states that conventional methods could be used to perform molding, folding, or embossing of the metallized composite. Col. 6:10-12.

## The File History

32. The '545 application was filed December 30, 1998, claiming priority to the '166 application, filed December 31, 1997. The original '545 application included claims 1-96. Claim 2 in the '545 application corresponds to issued claim 1 of the '138 patent. Claim 2 and its dependent claims were allowed essentially without amendments.

33. In the first Action issued October 13, 2000, claim 2 along with claims 3, 11, 16-18, 26-43, 45, 54-55, 57 and 61-70 were rejected under 35 USC 103(a) by U.S. Patent No. 4,115,619 (Kurfman '619) or U.S. Patent No. 4,211,822 (Kurfman '822) in view of U.S. Patent No. 4,407,871 (Eisfeller) or U.S. Patent No. 4,101,698 (Dunning). Also, claims 17-19 and 22, which correspond to claims 16-18 and 21 of the '138 patent (the adhesive chemistry claims), were rejected under 103(a) over the two Kurfman references, Eisfeller and Dunning and further in view of U.S. Patent No. 4,503,189 (Igarashi).

34. In response to these rejections, the applicant filed an Amendment on November 28, 2000, cancelling claim 1. In support of claim 2, however, applicant argued that:

. . . To the contrary, both Kurfman, et al '619 and '822 teach away from employing a discontinuous metallized layer. . . .

...

Certain discontinuities in the metal layer are taught by Kurfman, et al '619 and '822 as being tolerable. . . .

...

However, such pinholes in a continuous metal layer do not cause the formation of a “discontinuous layer of discrete island of metal” as employed in Applicant’s claimed invention.

November 28, 2000, Amendment, at 4, lines 8-25. Applicant also argued that “. . . these references [the two Kurfman references and Dunning] teach away from employing a layer of discrete islands of metal, because such a layer would not be considered a continuous metal layer.” *Id.* page 5, lines 24-26. In other words, applicant took the position that a person of ordinary skill in the art would not have combined the teachings of the Kurfman references relating to a laminate including a continuous metal film and the teachings of Eisfeller and Dunning relating to a laminate including a discontinuous metal film. Applicant also argued that “there is no disclosure or suggestion in either Eisfeller '871 or Dunning, *et al.* that the thermosets employed as at least one of the elastomeric layers could be substituted with thermoplastics to form either of Applicant’s claimed embodiments of the metallized composite.” *Id.* at 5, lines 26-29.

35. In the next Action, a final Action dated February 27, 2001, claims 2-37, which correspond to claims 1- 36 of the '138 patent, were allowed and claims 38-43, 45, 54, 55, 57 and 61-70 were rejected. Applicant kept fighting over the

patentability of these claims, but ended up cancelling all of the remaining claims in response to another Action rejecting these claims. A notice of allowance issued June 13, 2002.

### **VIII. THE PRIOR ART**

36. Following are brief summaries of the prior art references applied against the claims of the '138 patent in this declaration. The prior art references are exhibits to the accompanying Petition and referred to in my declaration by their exhibit numbers.

Japanese Patent Application Publication No. S63-286337 (Kuwahara)

37. My discussion of Kuwahara (Exhibit 1006) pertains to the translation provided to me, which is Exhibit 1007.

38. Kuwahara was published on November 24, 1998. I understand that Kuwahara was not cited during the prosecution of the '138 patent, and therefore was not considered by the Examiner of the '138 patent. Kuwahara relates to a decorative laminate, including a discontinuous metal layer on a first thermoplastic layer, an adhesive layer on the discontinuous metallized layer opposite the first thermoplastic layer, and a second metal layer on the adhesive layer. The decorative laminate in Kuwahara can be used, for example, as a trim for electronic equipment. Kuwahara uses a discontinuous metal layer in the laminate so that the



laminate is not electrically conductive and yet maintains metal luster as a decorative trim.

39. Kuwahara's laminate includes two thermoplastic layers, such as a polyethylene terephthalate (PET) layer and a vinyl chloride (VC) layer, and a discontinuous metal layer made of a low-melting point metal, such as tin, placed between the two thermoplastic layers. The metal layer is formed on one of the thermoplastic layers by a deposition technique, such as evaporation, ion plating or sputtering. The metal deposition is controlled so that, after the nucleation, the metal layer has a structure of islands. The separation between the metals islands is 100 – 5000 Å. Low-melting point metals, such as Sn, Pb, Zn and Bi, are easily formed into islands. An adhesive, a vinyl chloride-vinyl acetate copolymer, is used to attach the thermoplastic layer on which the metal islands are formed to another thermoplastic layer. The adhesive is applied to the metal layer by a roll coater, and then the two thermoplastic layers are laminated together using the adhesive under heat and pressure. Since the adhesive is applied on top of the discontinuous metal layer in a liquid state, the adhesive would inherently flow around the island metal structures so that islands of metal would be in the adhesive. Kuwahara states that the laminate can be colored and molded.

U.S. Patent No. 4,101,698 (Dunning)

40. Dunning was patented on July 18, 1978 and is Exhibit 1008. During prosecution of the '138 patent, Dunning was applied against the claims as a secondary reference to disclose a discontinuous metal layer. Dunning relates to a decorative laminate, including a discontinuous metallized thermoplastic layer, used as a trim for automobiles. Dunning uses the discontinuous metal layer in the laminate to reduce corrosion of the laminate. Dunning's laminate includes a metallized thermoplastic layer, such as a polyurethane layer, and an adhesive applied on the metallized surface of the thermoplastic layer. The laminate is attached to an automotive part, such as a bumper or other substrate using the adhesive. The bumper or other substrate may be a second thermoplastic layer since these substrates may be made of thermoplastic materials, such as urethane rubber. The metal layer is formed on the thermoplastic layer by a deposition technique, such as evaporation and electroless plating. The metal deposition is controlled so that the metal film has a thickness of 0.01 mil (2540 Å) or less and includes discontinuous dots. Dunning states that the metals that can be used for this metallization include chromium, aluminum and indium. Dunning states adhesives such as a vinyl coating adhesive or acrylic adhesive may be used. Dunning also states that the adhesives may include pigments and the laminates may be molded.

U.S. Patent No. 4,403,004 (Parker)

41. Parker was patented on September 6, 1983 and is Exhibit 1009.

Parker was listed in an Information Disclosure Statement filed by the applicant of the '138 patent but was not relied on by the Examiner. Parker relates to a decorative laminate, including a metallized thermoplastic layer, that can be used for trim for automobiles. Parker describes a laminate structure with reduced delamination problems including a first thermoplastic layer, a thin metal layer, which has a thickness of 100 to 200 Å, an adhesive on the side of the metal layer opposite the first thermoplastic layer, and a second thermoplastic layer on the adhesive layer opposite the metal layer. Parker states that the thermoplastic polyethylene terephthalate (PET) may be used to form the thermoplastic layers. Parker states that the thin metal layer may be formed from a variety of metals including chromium, nickel and aluminum. The metal layer is formed on one of the thermoplastic layers by a deposition technique, such as evaporation. An adhesive, such as a silicone resin or an acrylic polymer, is used to attach the thermoplastic layer on which the metal islands are formed to another thermoplastic layer. The adhesion process may be performed under pressure or heat. Parker discloses that laminates may be colored and that the laminate may be molded.

U.S. Patent No. 4,275,099 (Dani)

42. Dani was patented on June 23, 1981 and is Exhibit 1010. Dani was not cited during the prosecution of the '138 patent. Dani relates to a decorative laminate that can be used for trim for automobiles. The laminate in Dani includes a first thermoplastic layer, a metal layer on the first thermoplastic layer, an adhesive layer on the metal layer opposite the first thermoplastic layer, and a second thermoplastic layer on the adhesive layer opposite the metal layer. Dani uses a uniform metal layer and reduces the delamination problem of the laminate by using adhesives such as a polyurethane adhesive formed by the reaction of the isocyanate with hydroxyl groups of the polyester polyol. Dani's two thermoplastic layers may be formed from thermoplastics such as polyethylene terephthalate (PET) and polyvinyl chloride (PVC), and a metal layer made of metals, such as aluminum, placed between the two thermoplastic layers. The metal layer is formed on one of the thermoplastic layers by a deposition technique, such as evaporation. An adhesive that includes polyurethane formed by the reaction of the isocyanate with hydroxyl groups of the polyester polyol is used to attach the metallized layer to the second thermoplastic layer. The adhesive is applied to the metal layer on the first thermoplastic layer by a roller, dried and then placed on the second thermoplastic layer. The stack is then laminated under pressure and heat. Dani states that these plastic automotive parts may be colored and molded.

U.S. Patent No. 5,532,045 (Wade)

43. Wade was patented on July 2, 1996 and is Exhibit 1011. Wade was not cited during the prosecution of the '138 patent. Wade relates to a decorative laminate that can be used as trim for automobiles. The laminate in Wade includes a first thermoplastic layer, a patterned metal layer on the first thermoplastic layer, an adhesive layer on the metal layer opposite the first thermoplastic layer, and a second thermoplastic layer on the adhesive layer opposite the patterned metal layer. Wade reduces weathering and corrosion problems of the laminate by forming the laminate such that the patterned metal layer is not exposed at the edge of the laminate. Wade's two thermoplastic layers may be formed from thermoplastics such as a polyester and polyurethane. The patterned metal layer may be formed from a variety of metals, for example aluminum. The metal layer is formed on one of the thermoplastic layers by a deposition technique, such as evaporation, sputtering, ion beam deposition and chemical vapor deposition. Wades states that the adhesive layer may be formed from a polyester, an acrylic, a polyamide, an epoxy or a urethane adhesive. This adhesive is used to attach the first thermoplastic layer and the patterned metal layer to the second thermoplastic layer. Wade states that the thermoplastic layers and the adhesive may be colored. Wade also states that the laminate may be molded.

U.S. Patent No. 4,407,871 (Eisfeller)

44. Eisfeller was patented on October 4, 1983 and is Exhibit 1012.

Eisfeller was applied against the claims as a secondary reference to disclose a discontinuous metal layer during the prosecution of the '138 patent. Eisfeller relates to a decorative laminate, including a metallized thermoplastic layer, used as a trim for automobiles. Eisfeller discloses a first thermoplastic layer and a discontinuous metal layer on the surface of the first thermoplastic layer. Eisfeller discloses that the use of the discontinuous metal layer improves corrosion resistance and adhesion between the metal layer and the base thermoplastic layer. The metal layer has a thickness less than 600 Å and is electrically non-conductive. Eisfeller also states that indium layers have better reflectivity than aluminum layers. In Eisfeller, the metal layer is deposited on the thermoplastic layers such as thermoplastic urethane and ABS. The metal layer is applied to the thermoplastic layer, by deposition techniques, such as evaporation.

U.S. Patent No. 4,503,189 (Igarashi)

45. Igarashi was patented on March 5, 1985 and is Exhibit 1013. Igarashi was applied against the claims as a secondary reference to disclose the chemistry features of the adhesive during the prosecution of the '138 patent. Igarashi relates to adhesives for plastic films and metallized plastic films. The metallized plastic films include PET films. The metals of the metallized layer in Igarashi include

aluminum, nickel, and chromium and are deposited by evaporation onto the plastic film. The adhesive includes (A) a polyester polyol, polyester polyurethane polyol or their mixture, (B) a silane coupling agent, (C) a vinyl-chloride copolymerization resin, (D) a diene synthetic rubber and (E) an organic polyisocyanate.

European Patent Application Publication No. 0 738 580 (Ohta)

46. Ohta was published on October 23, 1996 and is Exhibit 1014. Ohta was not cited during the prosecution of the '138 patent. Ohta discloses a bumper made of layers of thermoplastic polymers, such as PET and ABS. Ohta's bumper is made by injection molding.

U.S. Patent No. 4,010,297 (Wenrick)

47. Wenrick was patented on March 1, 1977 and is Exhibit 1015. Wenrick was not cited during the prosecution. Wenrick discloses the decorative trim for automobiles may be colored.

U.S. Patent No. 4,397,896 (Moran)

48. Moran was patented on August 9, 1983 and is Exhibit 1016. Moran was not cited during prosecution. Moran discloses embossing decorative trim for automobiles.

**IX. VALIDITY**

49. I have found that claims 1-3, 8, 10, 16-19, 21 and 25-36 are anticipated by, or obvious in view of, the prior art references discussed above separately or in combination, for the reasons discussed below.

**Kuwahara**

50. Claims 1-3, 8, 10, 16-19, 21 and 25-36 are anticipated by Kuwahara or obvious in view of Kuwahara alone or in combination with additional references.

51. Claim 1 recites:

1. A metallized composite, comprising: a) a first thermoplastic layer; b) a discontinuous layer on said first layer, said discontinuous layer including discrete islands of metal in an adhesive; and c) a second thermoplastic layer, said discontinuous layer being between said first and second thermoplastic layers.

52. As explained below, Kuwahara discloses two examples, Examples 1 and 2, each of which meets all of the limitations of claim 1. In the examples, Kuwahara discloses a metallized composite. The PET layer is “. . . a) a first thermoplastic layer.” The Sn layer is “b) a discontinuous layer on said first layer, said discontinuous layer including discrete islands of metal in an adhesive.” The vinyl chloride-vinyl acetate copolymer resin is the adhesive. The PVC layer is “c) a second thermoplastic layer.” Finally, “said discontinuous layer being between



said first and second thermoplastic layers.” This structure disclosed in the Examples is illustrated below:

PET film (1 <sup>st</sup> thermoplastic layer)
Islands of Sn in a vinyl chloride-vinyl acetate copolymer resin (discontinuous metallized layer in adhesive)
VC film (2 <sup>nd</sup> thermoplastic layer)

53. Following is a more detailed explanation of how Kuwahara anticipates or renders obvious claims 1-3, 8, 10, 16, 17, 19, 21 and 25-36.

54. Kuwahara discloses “a metallized composite” because it states that “[t]his invention relates to a molded article having metallic luster and insulating properties, the molded article being composed of a molded body and a metalized film adhered thereto, wherein the vapour deposited metal layer of the metalized film is provided in an island structure so as to have insulating properties.”

Translation, at 3:1-6. The metalized film alone or in combination with the molded body is a metallized composite as claimed.

55. Kuwahara discloses “a first thermoplastic layer” because it states that “[a]s a film for use in the metalized film, polyethylene terephthalate film, polypropylene film, polyethylene film, polyvinylchloride film or any of other various plastic films can be used.” *Id.* at 3:24-27. Further, Kuwahara discloses “[i]n example 1 and example 2, a deposited Sn layer was provided in an island structure shown below on one surface of a 12 μm thick elongated piece of a

polyethylene terephthalate film by performing vacuum deposition under evaporation conditions shown below with a semi-continuous vacuum deposition apparatus.” *Id.* at 5:14-19. In the examples, one of ordinary skill in the art would have understood that the polyethylene terephthalate (PET) film on which Sn islands are deposited corresponds to the first thermoplastic layer, because PET is a well-known thermoplastic material.

56. Kuwahara discloses “a discontinuous layer on said first layer” because Kuwahara’s metal layer is formed as “an island structure,” as explained above. Also, Kuwahara states that “. . . the metalized film or the deposited metal layer is provided in an island structure so as to have insulating properties.” *Id.* at 3:14-15. In Kuwahara, the deposited Sn layer has an island size of 0.4  $\mu\text{m}$ , and the distance between islands is 500  $\text{\AA}$ . Translation, table at 5.

57. Kuwahara discloses “said discontinuous layer including discrete islands of metal in an adhesive” because it states that “. . . a *vinyl chloride-vinyl acetate copolymer resin* was applied to the deposited Sn layer of the examples to a thickness of 2  $\mu\text{m}$  with a roller coater, then heated with a 200  $\mu\text{m}$  thick polyvinylchloride film and laminated under pressure.” *Id.* Examples, at 5:19-22 (emphasis added). Vinyl chloride-vinyl acetate copolymer resin was a common known adhesive used to adhere a metalized film to a vinyl chloride film and other plastic films. For example, *see* Dunning, col. 5:66-6:4, stating that a “copolymer

of 85 to 88% vinyl chloride, 10.8 to 14.2% vinyl acetate, and 0.8 to 1.2% maleic acid” is an adhesive for attaching a metallized thermoplastic layer to another thermoplastic layer. See also the discussion on the adhesive in the Dunning section. Accordingly, one of ordinary skill in the art would have understood that the vinyl chloride-vinyl acetate copolymer resin in Kuwahara was an adhesive. One of ordinary skill in the art would have also understood that since the adhesive (vinyl chloride-vinyl acetate copolymer resin) is applied by a coater to the Sn islands deposited on the PET film, the Sn islands are in the adhesive.

58. Kuwahara discloses “a second thermoplastic layer” because one of ordinary skill in the art would have understood that the polyvinylchloride (PVC) film attached to the metallized PET film by the adhesive was a well-known thermoplastic layer. Kuwahara also discloses “said discontinuous layer being between said first and second thermoplastic layers” because Kuwahara’s Sn metal layer is between the PET film and the PVC film in the examples.

59. Claim 2 is anticipated by Kuwahara. Claim 2 recites, “. . . said first and second thermoplastic layers are laminated together.” Kuwahara discloses this limitation because in Examples 1 and 2 Kuwahara’s metallized PET film and PVC film are laminated using the adhesive (vinyl chloride-vinyl acetate copolymer resin).

60. Claim 3 is anticipated by Kuwahara. Claim 3 recites “. . . at least one of the thermoplastic layers includes polyethylene terephthalate.” Kuwahara discloses this limitation because Kuwahara’s first thermoplastic layer on which the Sn islands are deposited is made of PET in Examples 1 and 2, as explained above.

61. Claim 8 would have been obvious in view of Kuwahara alone or in combination with Eisfeller. Claim 8 recites “. . . the first thermoplastic layer includes acrylonitrile butadiene styrene.” Acrylonitrile butadiene styrene (ABS) was a well-known thermoplastic in this art, as I explained in section VI above. Kuwahara acknowledges that “[a]s a film for use in the metalized film, polyethylene terephthalate film, polypropylene film, polyethylene film, polyvinylchloride film or *any of other* various plastic films can be used.” Translation at 3:24-27 (emphasis added). Accordingly, prior to the earliest effective filing date of the ’138 patent, it would have been obvious to one of ordinary skill in the art to use an ABS layer in Kuwahara as a known substitute for the PET layer.

62. Further, claim 8 is obvious over Kuwahara and Eisfeller. Eisfeller discloses an ABS layer used as the first thermoplastic layer. Eisfeller discloses formation of discrete islands of metal on a thermoplastic film.

The present invention is based on the finding that with a thin vacuum metallized layer if the metal layer as it is being deposited or coalesced into electrically discrete islands and maintained electrically

non-conductive, the metal layer is corrosion resistant if adequately topcoated even though the metal is one that is corrosion prone such as indium. . . .

Col. 4:64-5:2. Eisfeller's ". . . invention is most usefully applied to" tin and other metals. Col. 6:23-28. Eisfeller's metals are deposited on an ABS layer. Col. 6:57-59.

63. Both Kuwahara and Eisfeller use tin as the coating metal. One of Kuwahara's objectives is to make an electrically non-conductive laminate film. Translation at 3:1-6. Eisfeller achieves this objective by depositing the same metal, tin, as a discontinuous layer, on an ABS layer to achieve non-conductivity of the laminate film. As Kuwahara specifically references that other types of plastic films could be used, it would have been obvious to a person of ordinary skill in the art to use Eisfeller's ABS for depositing the same metal, tin, to achieve non-conductivity of the laminate film in Kuwahara prior to the earliest effective filing date of the '138 patent. This would have been a simple substitution and the result would have been predictable.

64. Claim 10 is anticipated by Kuwahara. Claim 10 recites ". . . the first thermoplastic layer includes thermoplastic olefin." One of ordinary skill in the art would have understood that an olefin is any unsaturated hydrocarbon containing one or more pairs of carbon atoms linked by a double bond. Kuwahara discloses this limitation because Kuwahara's first layer may be polypropylene or

polyethylene. Translation at 3:2-27. One of ordinary skill in the art would have understood that polypropylene and polyethylene are thermoplastic olefins.

65. Claim 16 would have been obvious in view of Kuwahara alone or in combination with Wade, Igarashi or related technical information. Claim 16 recites “. . . said adhesive includes at least one component selected from the group consisting of styrene-butadiene copolymers, ethylvinyl acetates, polyesters, polyamides, acrylic pressure-sensitive adhesives, silicone pressure-sensitive adhesives, polyurethanes and isocyanate-crosslinked polymers.” The adhesives recited in claim 16 cover many of the most commonly used adhesives in the art. All were well-known adhesives used for laminating thermoplastic layers.

66. The technical literature contains volumes of information on the types of adhesives that are commonly used for joining plastics, including plastic films. I have highlighted a few references below. These references clearly demonstrate that the adhesives listed in claim 16 were routinely used in the film laminate and plastics industries, and were obvious to anyone even remotely skilled in the art.

67. DuPont’s Tedlar® polyvinyl fluoride film (PVF) product literature lists the following types of adhesives that are useful with Tedlar® PVF film: modified acrylic, polyester-isocyanate, epoxy, urethane, silicone RTV, phenolic, rubber, acrylic pressure sensitive, and silicone pressure sensitive. This literature accompanies my declaration at Appendix B.

68. “Chapter 117 - Adhesion and Solvent Bonding,” Rubin, I.I., *Handbook of Plastic Materials and Technology*, Wiley Interscience, 1990, encompasses nearly every aspect of adhesives recited in claim 16. I have attached a copy of the relevant parts of that chapter at Appendix C, and have underlined and marked with an asterisk the most germane portions. The following highlights a few of the most significant disclosures.

- “Adhesive bonding of plastic substrates is already a common practice.” *Id.* at 1641.
- Adhesives have the ability to bond thin films, and dissimilar materials. *Id.*
- The importance of surface tension of the materials being bonded. *Id.* at 1642.
- Lists the five basic physical types of adhesives. Also states “Often these consist of two parts...” *Id.*
- Table 117.1 lists common adhesives, and includes every adhesive recited in claim 16. Styrene-butadiene from claim 16 is not mentioned specifically in Table 117.1, but falls under the generic term “rubber” in 117.1. Note that page 1643 includes a statement that “[i]n addition to unlisted additional compositions that fall in each category [i.e., from Table 117.1], there are many mixtures or blends of two or more chemical types, called hybrids”.

- The need for a primer with some adhesives. *Id.* at 1644.
- In Table 117.3, the SBR in parenthesis after rubbers is styrene-butadiene. *Id.* at 1646.
- Table 117.5 is particularly relevant because it lists just about every adhesive and thermoplastic film material recited in claim 16. *Id.* at 1648.

69. So, it would have been obvious to one of ordinary skill in the art to use at least one of the recited adhesives in Rubin as a known substitute for Kuwahara's adhesive.

70. Further, claim 16 is obvious in view of Kuwahara and Wade. Wade discloses the adhesives recited in claim 16. Wade discloses a laminate structure including a first polymer layer 20, a metal layer 26, an adhesive layer 30, and a second polymer layer 40. Col. 4:23-29, 5:53-6:39, and FIGS. 1 and 2. The first polymer layer may be polyester. Col. 4:8-15. The metal is aluminum or other metals. Col. 4:56-59. The second polymer layer/substrate layer may be polyvinyl chloride. Col. 6:21-27. "Generally, adhesive 30 can be a thermoplastic or cross-linked (with or without aid of an active or latent crosslinking agent) *polyester*, acrylic, *polyamid* or *urethane* adhesive capable of preventing delamination of vehicle part 10 as well as polyvinylchloride or epoxy, or mixtures of any of the above." Col. 5:59-64 (emphasis added).



71. Kuwahara's first thermoplastic layer can be PET, which is a polyester. Kuwahara's second thermoplastic layer is vinyl chloride film. Replacing Kuwahara's adhesive (vinyl chloride-vinyl acetate copolymer resin) with Wade's adhesive, such as polyester, polyamid or urethane, would have been an obvious design modification based on a known alternate, because both adhesives join similar materials (a polyester and a PVC) and are used to form similar structures. I also note that none of the adhesives recited in claim 16 was known as being only limited to use with a specific metal, especially based on my view explained in section VI that the adhesion between a metal and an adhesive is determined mainly by the bonding between the adhesive and the hydroxyl groups and oxides formed on the metal surface. For that reason, one of ordinary skill in the art would have understood that Wade's adhesives would be similarly effective for both Wade and Kuwahara.

72. In addition, claim 16 is obvious in view of Kuwahara and Igarashi. Igarashi discloses an adhesive for plastic films and metalized films. *See* Abstract; *see also* col. 5:46-53. The metals that are specifically listed for metallization are aluminum, nickel, chrome and their alloys. Col. 1:8-16. Igarashi's adhesive includes ". . . (A) a *polyester* polyol, polyester *polyurethane* polyol or their mixture, (B) a silane coupling agent, (C) a vinyl-chloride copolymerization resin, (D) a diene synthetic rubber and (E) an organic *polyisocyanate*." Col. 2:3-8

(emphasis added); *see also* Table 1. Replacing Kuwahara’s adhesive with Igarashi’s adhesive would have been an obvious design modification to one of ordinary skill in the art, because both adhesives are used for metallized PET films and the applications for both Kuwahara and Igarashi include decorative articles for electrical equipment. Translation of Kuwahara, 1:3-7.

73. Claim 17 would have been obvious in view of Kuwahara in combination with Wade or Igarashi. Claim 17 recites “. . . the adhesive is a thermally activated adhesive.” Wade discloses this limitation because it states that its “adhesive 30 can be cured merely by the application of pressure, by the *application of heat and pressure.*” 6:34-36 (emphasis added). It would have been obvious to one of ordinary skill in the art to use Wade’s adhesive layer in place of Kuwahara’s adhesive layer, as explained above. Igarashi also discloses this limitation because it states that “[i]n conducting a bonding treatment with the use of the adhesive composition according to the present invention, the conventionally employed methods, such as the method which comprises allowing the composition to adhere to the surface of a film by a dry laminator, etc., evaporating a solvent if used, mating the surfaces to be bonded and curing the composition at ordinary temperature or *under heating*, are adopted.” Col. 5:36-43 (emphasis added). It would have been obvious to one of ordinary skill in the art to use Igarashi’s adhesive layer in place of Kuwahara’s adhesive layer, as explained above.

74. Claim 18 would have been obvious in view of Kuwahara alone or in combination with Wade or Igarashi. Claim 18 recites “. . . the adhesive includes two components.” Adhesives including multiple components were well-known in this art, as I explained with respect to claim 16.

75. Wade states that “[g]enerally, adhesive 30 can be a thermoplastic or cross-linked (*with or without aid of an active or latent crosslinking agent*) polyester, acrylic, polyamid or urethane adhesive capable of preventing delamination of vehicle part 10 as well as polyvinylchloride or epoxy, *or mixtures of any of the above.*” Col. 5:59-64 (emphasis added). Igarashi’s adhesive includes five different components: “. . . (A) a polyester polyol, polyester polyurethane polyol or their mixture, (B) a silane coupling agent, (C) a vinyl-chloride copolymerization resin, (D) a diene synthetic rubber and (E) an organic polyisocyanate,” as I explained above. I have already explained that it would have been obvious to one of ordinary skill in the art to use Wade’s adhesives or Igarashi’s adhesives in Kuwahara as a known substitute with a predictable result.

76. Claims 19 and 21 would have been obvious in view of Kuwahara alone or in combination with Igarashi or Dani. Claim 19 recites “. . . the adhesive includes polyester and isocyanate,” and claim 21 recites “. . . the adhesive includes polyurethane and isocyanate.” The multi-component adhesives recited in claims

19 and 21 were well-known in the art. Igarashi discloses the limitations of claim 19 and the limitations of claim 21. *See* Igarashi's five-component adhesive above.

77. Further, Dani also discloses similar multi-component adhesives. Dani discloses a laminate film including a polyester film layer 10, a metallized layer 11, an adhesive layer 13, and a vinyl film layer 20. Col. 2:51-3:7, and FIG. 1. The polyester film may be PET. Col. 8:39-44. The adhesive includes polyester and isocyanate. Col. 4:63-68, and 5:45-47. "In accordance with the present invention, a novel metalized resin film--containing laminate of improved weathering properties and enhanced resistance to delamination is obtained by employing as an adhesive bond between said film and the film layer next adjacent the metalized surface, a specially developed in-situ formed *polyester-isocyanate polyurethane*." Col. 2:5-11 (emphasis added).

78. It was well known in the art that adhesives that worked well with one type of thin metal layer would work well with other metal layers since the binding to the metal layer is primarily to hydroxide groups that are located on most metal substrates. *See*, for example: Perfetti, B., "Metal Surface Characteristics Affecting Organic Coatings", *Federation Series On Coatings Technology*, published by the Federation of Societies for Coatings Technology, Blue Bell, PA, Aug. 1994, p. 8 and p. 15; and Fontana, M.G., *Corrosion Engineering*, 3<sup>rd</sup> ed., Mc-Graw-Hill,

1986, p. 236 and p. 239. These references accompany my declaration at Appendices D and E respectively.

79. Kuwahara's first thermoplastic layer can be PET. Kuwahara's second thermoplastic layer is vinyl chloride film (PVC). Replacing Kuwahara's adhesive with Dani's adhesive would have been an obvious design modification based on a known alternate, because Dani is used to join the same polymer materials (PET and PVC) to form the same structure of PET layer/metal layer/ adhesive layer/ PVC layer and the choice of metal would not have affected the choice of adhesive as explained above.

80. Claim 25 would have been obvious in view of Kuwahara in combination with Eisfeller. Claim 25 recites ". . . said metal is indium." Kuwahara states that "[a]s a film for use in the metalized film, polyethylene terephthalate film, *polypropylene* film, polyethylene film, polyvinylchloride film or any of other various plastic films can be used." Translation, page 3:24-27 (emphasis added). Kuwahara says that low melting point metals are good for the metal coating and lists Sn, Pb, Zn and Bi as examples. Translation, page 4:17-27.

81. Eisfeller discloses formation of discrete islands of metal on a thermoplastic film.

The present invention is based on the finding that with a thin vacuum metallized layer if the metal layer as it is being deposited or coalesced into electrically discrete islands and maintained electrically

non-conductive, the metal layer is corrosion resistant if adequately topcoated even though the metal is one that is corrosion prone such as *indium*. . . .

Col. 4:64-5:2 (emphasis added); *see also* 2:52-56. Eisfeller says that polypropylene is used as the first thermoplastic layer. Col. 6:57-59.

82. The melting point of tin is 232°C, and the melting point of indium is 157°C. On the other hand, the melting point of aluminum is 660°C. Accordingly, indium is a low melting point metal as preferred by Kuwahara—indeed it has a lower melting point than the metals specifically listed in Kuwahara. In addition, one of Kuwahara’s objectives is to make an electrically non-conductive laminate film. Translation, page 3:1-6. Eisfeller achieves this objective. Further, both Kuwahara and Eisfeller use polypropylene as the first thermoplastic layer.

83. Accordingly, it would have been obvious to one of ordinary skill in the art to replace Kuwahara’s tin layer with Eisfeller’s indium layer, because both tin and indium have a low melting point and are deposited on the same thermoplastic layer in both Kuwahara and Eisfeller. This would have been a simple substitution of a known element for another known element with a predictable result.

84. Claim 26 is anticipated by Kuwahara. Claim 26 recites “. . . said metal is selected from the group consisting of zinc, tin, gallium, aluminum, cadmium, copper, nickel, cobalt, iron, stainless steel, gold, platinum, chromium,

nichrome, palladium, and rhodium.” Kuwahara discloses this limitation because Kuwahara’s metal layer is a Sn layer. Translation, page 5:14. The atomic symbol of tin is Sn. Further, Kuwahara says that low melting point metals are good for the metal coating and lists zinc as an additional example. Translation, page 4:17-27.

85. Claim 27 would have been obvious in view of Kuwahara alone or in combination with Wade. Claim 27 recites “. . . at least one of said thermoplastic layers is tinted.” Tinting of a thermoplastic layer was well known in this art.

86. Wade discloses a laminate structure including a first polymer layer 20, a metal layer 26, an adhesive layer 30, and a second polymer layer 40. Col. 4:23-29, 5:53-6:39, and FIGS. 1 and 2. The first polymer layer may be polyester. Col. 4:8-15. “These polymers can be clear or *tinted*.” (emphasis added). Col. 4:12-13. Kuwahara states that “[n]eedless to say, a coloured or uncoloured protective film may exist on the deposited metal layer.” Translation, page 3:19-21. Kuwahara’s first thermoplastic layer can be PET, which is a polyester. Adding Wade’s tinting to Kuwahara’s PET layer would have been an obvious design choice to one of ordinary skill in the art, given Kuwahara’s express statement that the protective layer may be colored.

87. Claim 28 would have been obvious in view of Kuwahara alone in combination with Wade. Claim 28 recites “the adhesive layer is tinted.” Wade states that “[a]dvantageously, adhesive 30 is colored or pigmented, to match or

complement either the interior or exterior colors of the car. Different pigments, such as metallic or pearlescent pigments, can be included in adhesive 30 in addition to micronized titanium oxide, fluorescent pigments or graphite.

Additionally, other dye, coloring or pigment materials can be included to provide the desired color and appearance to vehicle part 10.” Col. 5:66-6:6. Wade’s adhesive layer is tinted by being “. . . colored or pigmented, to match or complement either the interior or exterior colors of the car.” Col. 5:66-6:1.

Adding pigments, graphite, dye, or coloring materials to an adhesive would result in tinting of the adhesive. Kuwahara’s first thermoplastic layer is PET, which is polyester. Kuwahara’s second thermoplastic layer is vinyl chloride film.

Replacing Kuwahara’s adhesive (vinyl chloride-vinyl acetate copolymer resin) with Wade’s tinted adhesive would have been an obvious design modification to one of ordinary skill in the art, because both adhesives join similar materials (a polyester and a PVC) and are used to form similar structures.

88. Claim 29 would have been obvious in view of Kuwahara alone or in combination with Wade. Claim 29 recites “. . . at least one of said thermoplastic layers is tinted with a dye.” Tinting a thermoplastic layer using a dye was well known in this art. For example, the passage of Wade reproduced above with respect to claim 28 discloses that a dye can be used to tint an adhesive.



Accordingly, tinting a thermoplastic layer using a dye would have been a well-known design choice with a predictable result.

89. Claim 30 would have been obvious in view of Kuwahara alone or in combination with Wade. Claim 30 recites “. . . either of said first or second thermoplastic layers includes carbon black.” Tinting a thermoplastic layer using carbon black was well known in this art. For example, Wade states:

Advantageously, adhesive 30 is colored or pigmented, to match or complement either the interior or exterior colors of the car.

Different pigments, such as metallic or pearlescent pigments, can be included in adhesive 30 in addition to micronized titanium oxide, fluorescent pigments or *graphite*. Additionally, other dye, coloring or pigment materials can be included to provide the desired color and appearance to vehicle part 10.

Col. 5:66-6:6 (emphasis added). Wade refers to “graphite” as pigments. One of ordinary skill in the art would have understood that carbon-based pigments are carbon black not graphite. *See*, for example, Timm, J. A., *General Chemistry*, 3<sup>rd</sup> ed., McGraw-Hill Inc., 1956, p. 407, The American Heritage Dictionary, Second College Edition, Houghton Mifflin Co., p.96, Wicks, Z.W. et. al., *Organic Coatings Science & Technology*, 3<sup>rd</sup> ed., Wiley Interscience, 2007, p. 427, and Kroschwitz, J., *Concise Encyclopedia of Polymer Science and Engineering*, Wiley Interscience, 1998, p. 104 (Appendices F, G, H and I). Kuwahara states that “[n]eedless to say, a coloured or uncoloured protective film may exist on the

deposited metal layer.” Translation, page 3:19-21. Adding Wade’s tinting to Kuwahara’s PET layer would have been an obvious design choice, given Kuwahara’s express statement that the protective layer may be colored. It would have been further obvious to use graphite to tint the thermoplastic layer given that the adhesive in Wade is tinted with graphite.

90. Claim 31 is anticipated by Kuwahara. Claim 31 recites “. . . the first and second thermoplastic layers predominantly include different thermoplastic polymer components.” Kuwahara discloses this limitation because Kuwahara’s first thermoplastic layer can be PET and Kuwahara’s second thermoplastic layer can be a vinyl chloride film, as explained above. PET is different from PVC.

91. Claim 32 is anticipated by Kuwahara. Claim 32 recites “. . . said metal islands preferentially adhere to one of the two thermoplastic layers.” As explained above, Kuwahara discloses that the first thermoplastic layer includes “. . . polyethylene terephthalate film, polypropylene film, polyethylene film, polyvinylchloride film or any of other various plastic films can be used.” Translation, page 3:22-25. Kuwahara’s second thermoplastic layer is, for example, a vinyl chloride film, as explained above. In other words, Kuwahara’s first and second thermoplastic layers can be made of different materials.

92. All materials have a different affinity to each other. This is in part due to their different surface tensions, dictated by the basic laws of

thermodynamics. “The molecules or atoms at the surface of a homogeneous solid or liquid are in a different environment from those in the interior.” [1] The surface reactivity of any material can be expressed by its surface tension (units of dynes/cm); the lower the dynes/cm, the lower its reactivity. The following table (values taken from various references, as noted) shows the different surface tensions, and therefore surface affinities of the thermoplastic materials recited in claim 32 are different.

**Surface Tensions of Various Plastics Listed in ‘138 Patent and/or Claim Charts**

<b><u>Polymer</u></b>	<b><u>Surface Tension (dynes/cm)</u></b>	<b><u>Ref.</u></b>
PET	~42	3
ABS	35	6
PP	29 – 30	2
PE	33 – 37	2
PVC	41.9	1
PVF	36.7	4, 5
Styrene-butadiene	29	6
Polyethyl vinyl acetate	36.5	1
Acrylic (PMMA)	41.0	1
PU	36 – 39	2
PC	43 – 45	2
PVDF	33	2
PTFE	21.5	1
Epoxy	45 – 52	2

[1] Baghdachi, J.A., “Adhesion Aspects of Polymeric Coatings”, *Federation Series On Coating Technology*, published by the Federation of Societies for Coating Technology, Blue Bell, PA, Dec., 1996, p. 13 (Appendix J).

[2] Van Iseghem, L.C., “Coating Plastics – Some Important Concepts from a Formulators Perspective”, *Trends in Plastics Coatings*, <http://www.vtcoatings.com/plastics.htm> (Appendix K).

[3] NatureWorks LLC Product Literature NWF S017-020111, Ingeo Film Surface Treatment, [www.natureworkslc.com](http://www.natureworkslc.com) (Appendix L).

[4] Scheirs, J., *Modern Fluoropolymers*, John Wiley Sons, 1997, p. 165 (Appendix M).

[5] Wicks, Z.W. et. al., *Organic Coatings Science & Technology*, 3<sup>rd</sup> ed., Wiley Interscience, 2007, p.490 (Appendix H).

[6] “Determining Critical Surface Tension of Solid Substrates”, *SpecialChem*, Jan 24, 2007, <http://www.specialchem4adhesives.com/home/editorial.aspx?id=1785> (Appendix N).

93. Kuwahara discloses the limitation of claim 32 because different thermoplastic materials do not have the same affinity to the same metal, as explained above.

94. Claim 33 is anticipated by Kuwahara or would have been obvious in view of Kuwahara alone or in combination with Wade. Claim 33 recites “. . . said composite is supported by a substrate.” Kuwahara discloses a supporting substrate because it states that:

. . . a vinyl chloride-vinyl acetate copolymer resin was applied to the deposited Sn layer of the examples to a thickness of 2  $\mu\text{m}$  with a roller coater, then heated with a 200  $\mu\text{m}$  thick polyvinylchloride film and laminated under pressure. The thus obtained products were slit to 10 mm width, and the slit products, with the polyvinylchloride film inwards and the polyethylene terephthalate film outwards, *were adhered to a polyvinylchloride resin while being molded, so as to obtain molded articles having metal luster and insulating properties.*

Translation, page 5:19-27 (emphasis added). This process produces a laminate (PET film/metal islands in adhesive/PVC film) attached to a PVC resin. The PVC resin is the support for the laminate.

95. Further, it was well known in the art that thermoplastic laminates can be supported by a substrate. For example, Wade states that “[o]nce formed into the final shape of part 10, part 10 can be used as is or a backing material 50 such as a polyvinyl chloride, a polyolefin, an acrylonitrile-butadiene-styrene copolymer or a urethane can be molded into the rear of part 10 to provide *support*, as shown in FIGS. 5 and 6. This molding can be through injection or other types of molding, casting, or the use of a foaming material as would be familiar to the artisan.” Col. 6:56-63 (emphasis added). As is the case with Kuwahara’s polyvinylchloride resin, Wade’s backing material 50 serves as a substrate to support a thermoplastic laminate. It would have been obvious to attach Wade’s backing material 50 to Kuwahara’s laminate during molding, because both Kuwahara and Wade have

similar laminates (polyester/PVC) and are formed into a shape by injection molding.

96. Claim 35 would have been obvious in view of Kuwahara alone or in combination with Moran. Claim 35 recites “. . . said composite is embossed.” Embossing was well-known in this art. For example, Moran discloses embossing. Moran is directed to decorative trim for automobiles similar to those in Kuwahara. Col. 1:11-14. Moran states that:

Decorative trim strip assemblies have been applied to vehicles, particularly automobiles, vans and the like, for a great many years. Such trim strips have been in the form of side moldings or edgings, for both decorative and protective purposes. Usually such trim strips as body moldings and the like are formed of an extruded polyvinyl chloride or other polymeric resinous material; and they may have their outer surface covered or *embossed*, or a combination thereof, so as to give a particular desired decorative appearance and surface contour. For example, they may be covered with a pre-printed plastic film having such as a wood grain effect, or a metallized film such as polyethylene terephthalate which gives the outer surface of the trim strip a metallic--usually a bright metallic--appearance. . . .

Col. 1:21-31 (emphasis added). It would have been an obvious design choice to use Moran’s embossing in Kuwahara to achieve a particular decorative effect.

97. Claim 36 is anticipated by Kuwahara. Claim 36 recites “. . . said composite is molded.” Kuwahara discloses this limitation because it states that

“[t]he thus obtained products were slit to 10 mm width, and the slit products, with the polyvinylchloride film inwards and the polyethylene terephthalate film outwards, were adhered to a polyvinylchloride resin while being molded, so as to obtain molded articles having metal luster and insulating properties.” Translation, page 5:23-27.

### **Dunning**

98. Claims 1-3, 16, 17, 19, 21 and 25-36 are anticipated by Dunning or obvious in view of Dunning alone or in combination with additional references.

99. Claim 1 recites:

1. A metallized composite, comprising: a) a first thermoplastic layer; b) a discontinuous layer on said first layer, said discontinuous layer including discrete islands of metal in an adhesive; and c) a second thermoplastic layer, said discontinuous layer being between said first and second thermoplastic layers.

100. As explained below, Dunning discloses all of the limitations of claim

1. Dunning discloses a composite film that includes a) a first thermoplastic layer; and b) a discontinuous layer on said first layer, said discontinuous layer including discrete islands of metal in an adhesive. Dunning also discloses attaching this film using the adhesive to an article that includes c) a second thermoplastic layer, such that said discontinuous layer being between said first and second thermoplastic

layers. Following is a more detailed explanation of how Dunning anticipates claim or renders obvious claims 1-3, 16-19, 21 and 25-36.

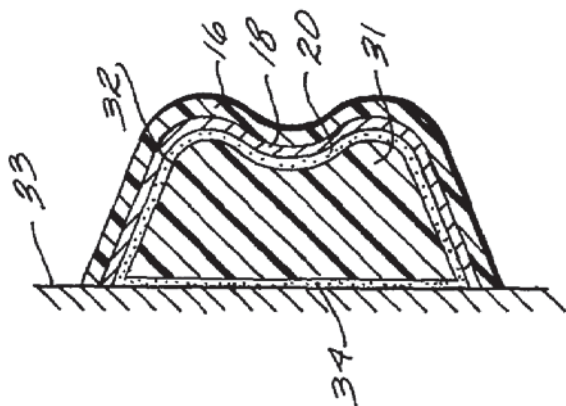
101. Dunning discloses “a metallized composite” because Dunning’s “. . . invention relates to decorative laminates, and more particularly to a transfer laminate for forming elastomeric reflective metal surfaces on articles of manufacture.” Col. 1:5-8. “Briefly, the invention provides a transfer laminate having a flexible transparent, or translucent, elastomeric layer, and a layer of metal bonded to the elastomeric layer in separate microscopically discontinuous planar quantities of high reflectivity.” *Id.* at 1:52-56. “The laminate also can provide a bright reflective metal finish on deformable articles such as articles subject to impacts. A typical use is for the impact-absorbing bumpers used in many late-model automobiles.” *Id.* at 3:3-6.

102. Dunning’s metalized sheet includes elastomeric film 16, metal layer 18 formed on the elastomeric film 16 and adhesive 20 applied to metal layer 18. *Id.* at 5:43-56; *see also* FIG. 1 below.



Dunning’s metalized sheet above can be attached to a plastic article 31. *Id.* at 5:56-62; *see also* FIG. 4 below.





103. Dunning discloses “a first thermoplastic layer” because it states that “[a] layer 16 of synthetic resinous elastomeric material, such as *polyurethane*, is coated over the release coating 14 to form a relatively thin, continuous, planar flexible and foldable elastomeric film or skin coat after the coating sets. A layer of metal 18, to be described in detail below, is applied to the surface of the elastomeric film 16.” *Id.* at 4:14-20 (emphasis added). “The preferred elastomer is a *thermoplastic* or thermosetting polyurethane film.” *Id.* at 4:49-53 (emphasis added).

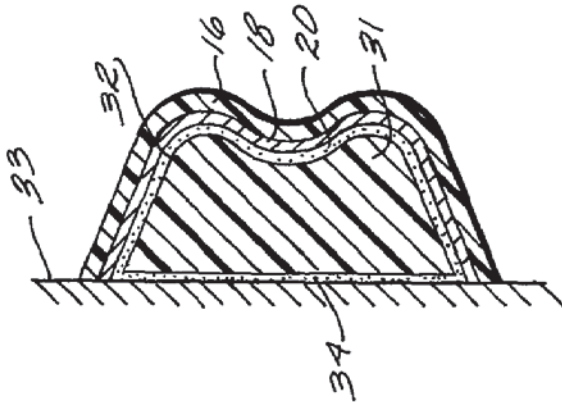
104. Dunning discloses “a discontinuous layer on said first layer” because it states that “[a] layer of metal 18, to be described in detail below, is applied to the surface of the elastomeric film 16” (col. 4:13-20) and that “[t]he layer 18 is made from a highly reflective, corrosion and abrasion-resistant metal, such as chromium. The metal is preferably applied by vacuum deposition techniques which bond the metal to the elastomeric film. Preferably, the reflective metal layer is deposited in a layer having a thickness of 0.01 mil or less, the metal layer being *vacuum-*

*deposited in discontinuous quantities, or separate planar reflective segments such as dots*, which are discontinuous but which are deposited so close together that they give the optical visual effect of a continuous, highly reflective metallized surface.” Col. 4:60-5:2 (emphasis added). Dunning’s metal layer 18 is a discontinuous layer because it is formed as discontinuous, separate dots.

105. Dunning discloses “said discontinuous layer including discrete islands of metal in an adhesive” because it states that “[a] layer 20 of adhesive overlays the reflective metal layer 18 to provide means for adhering the laminate 10 to a substrate. The adhesive 20 is one which not only bonds to the metal layer 18, but also is a flexible permanently thermoplastic adhesive which will not disrupt the ability of the laminate to elastically deform and return to its original shape” (col. 5:3-12) and that “[t]he adhesive layer 20 may be any permanent adhesive capable of bonding the metal layer 18 to the rigid plastic article. A vinyl coating such as Union Carbide’s VMCH vinyl resin (copolymer of 85 to 88% vinyl chloride, 10.8 to 14.2% vinyl acetate, and 0.8 to 1.2% maleic acid), as well as many acrylic adhesives, can be used” (col. 5:66-6:4). *See also* FIG. 1. Dunning’s dots are in Dunning’s adhesive layer 20, because the adhesive layer 20 overlays the dots.

106. Dunning discloses “a second thermoplastic layer” because Dunning discloses that the laminate including a thermoplastic layer, a discontinuous metal layer deposited on the thermoplastic layer and an adhesive layer applied to the

metal layer is attached to plastic article 31 using the adhesive layer. Col. 5:56-59; *see also* FIG. 4. The plastic article 31 corresponds to the second thermoplastic layer.



107. During the prosecution of the '545 application, the applicant distinguished Dunning from the claimed invention by stating that the second layer in Dunning is a thermoset layer not a thermoplastic layer as claimed. Specifically, applicant stated that Dunning discloses “. . . a substrate, such as urethane rubber, which is a thermoset,” and “. . . there is no disclosure or suggestion in either Eisfeller '871 or Dunning, *et al.* that the thermosets employed as at least one of the elastomeric layers could be substituted with thermoplastics to form either of Applicant's claimed embodiments of the metallized composite.” *See* November 28, 2000, Amendment, page 5, lines 8-9, and 26-29. This is incorrect.

108. First, Dunning states that the film can be bonded to “. . . deformable articles such as articles subject to impacts,” such as “. . . bumpers used in many late-model automobiles.” Col. 3:4-6. “For example, a laminate comprising a

transparent elastomeric film and an undersurface of vacuum-deposited metal, such as chromium, can be integrally bonded to the molded elastomeric impact-absorbing article.” *Id.* at 3:6-10. Thermoplastic elastomeric impact-absorbing articles, such as bumpers, were well known to persons of ordinary skill in the art, as described in Ohta below. Accordingly, persons of ordinary skill in the art would not have understood Dunning to be limited to thermoset substrates as stated by the applicant of the ’138 patent. Further, persons of ordinary skill in the art would have understood that Dunning discloses thermoplastic substrates. Accordingly, Dunning renders claim 1 anticipated.

109. Second, Dunning discloses an embodiment in which the laminate substrate is made of urethane rubber. *Id.* at 6:26-30. This molded article was made by injection molding. *Id.* at 6:36-37. Contrary to the applicant’s assertion during prosecution, urethane rubber can be thermoplastic or thermosetting. At the time of Dunning’s invention, plastic injection molding was primarily based on thermoplastic materials. Thus, one of ordinary skill in the art would have understood that Dunning’s disclosure of a urethane rubber substrate by plastic injection molding discloses a thermoplastic layer and renders claim 1 anticipated by Dunning for this additional reason.

110. This limitation is also obvious in view of Dunning and Ohta. Dunning discloses bonding a laminate to a bumper for improving automobile

trimming: “The laminate also can provide a bright reflective metal finish on deformable articles such as articles subject to impacts. A typical use is for the impact-absorbing bumpers used in many late-model automobiles. For example, a laminate comprising a transparent elastomeric film and an undersurface of vacuum-deposited metal, such as chromium, can be integrally bonded to the molded elastomeric impact-absorbing article.” Col. 3:3-10.

111. It was well known that a bumper can be made of layers of thermoplastic polymers. *See* the Abstract of Ohta. Thus, it would have been obvious to one of ordinary skill in the art to use a thermoplastic bumper as the second thermoplastic layer to which the metalized first thermoplastic layer is attached, because such a thermoplastic bumper layer was well known to one of ordinary skill in the art before the filing date of the '138 patent, as evidenced by Ohta.

112. Finally, Dunning discloses “said discontinuous layer being between said first and second thermoplastic layers” because Dunning’s metal layer is between the polyurethane layer and the second thermoplastic layer that forms part of the bumper, as explained above. In addition, Dunning’s metal layer is between elastomeric film 16 and plastic article 31.

113. Claim 2 is anticipated by Dunning or would have been obvious in view of Dunning alone or in combination with Ohta. Claim 2 recites, “. . . said

first and second thermoplastic layers are laminated together.” Dunning discloses this limitation because Dunning’s polyurethane layer and the second thermoplastic layer, which is part of the bumper or plastic article 31, are laminated with the adhesive. Further, Dunning’s elastomeric film 16 and plastic article 31 are laminated with the adhesive 20.

114. Claim 3 would have been obvious in view of Dunning in combination with Ohta. Claim 3 recites “. . . at least one of the thermoplastic layers includes polyethylene terephthalate.” Ohta discloses that polyethylene terephthalate (PET) may be used to form a thermoplastic layer of a bumper. *See* Tables 1 and 2. Attaching Dunning’s polyurethane layer to Ohta’s PET bumper layer would have been an obvious design choice to one of ordinary skill in the art, because Dunning explicitly states that the disclosed material can be attached to a bumper surface.

115. Claim 16 is anticipated by Dunning or would have been obvious in view of Dunning alone or in combination with Ohta or further in view of Dani or Igarashi. Claim 16 recites “. . . said adhesive includes at least one component selected from the group consisting of styrene-butadiene copolymers, ethylvinyl acetates, polyesters, polyamides, acrylic pressure-sensitive adhesives, silicone pressure-sensitive adhesives, polyurethanes and isocyanate-crosslinked polymers.” Dunning discloses this limitation because it states that “[a] vinyl coating such as Union Carbide's VMCH vinyl resin (copolymer of 85 to 88% vinyl chloride, 10.8

to 14.2% vinyl acetate, and 0.8 to 1.2% maleic acid), as well as *many acrylic adhesives*, can be used.” Col. 5:68-6:4 (emphasis added). “The adherence layer can be a layer of adhesive, such as a *pressure-sensitive*, or heat-activated adhesive.” Col. 2:50-52 (emphasis added). Accordingly, Dunning’s discloses a pressure sensitive acrylic adhesive, because Dunning’s adhesive can be an acrylic adhesive and can be pressure-sensitive.

116. Further, the adhesives recited in claim 16 cover many of the most common adhesives used in the art. All were well-known adhesives used for laminating thermoplastic layers, as I have already explained in the Kuwahara section.

117. Further, claim 16 is obvious in view of Dunning in combination with Dani. Dani also discloses the adhesives recited in claim 16. Dani relates to decorative metallized composites for automobiles. Col. 1:9-12. Dani discloses a three-layer laminate similar to Dunning’s laminate. Col. 2:11-17. In addition, Dani discloses that the adhesives (polyester, polyurethane, and isocyanate-crosslinked polymer) can be used to bond a metallized film to a second thermoplastic layer. “In accordance with the present invention, a novel metallized resin film--containing laminate of improved weathering properties and enhanced resistance to delamination is obtained by employing as an adhesive bond between said film and the film layer next adjacent the metallized surface, a specially

developed in-situ formed *polyester-isocyanate polyurethane*.” Col. 2:5-11 (emphasis added). “The metal coated surface of the film is bonded to a vinyl resin film by the in-situ formed thermosetting adhesive bond comprising the *polyurethane* formed by the reaction of the *isocyanate* with hydroxy groups of the polyester polyol.” Col. 2:18-22 (emphasis added). “To react with the hydroxyl polyester in the adhesive coating there is added thereto a mixture of certain organic *polyisocyanates* and suitable tertiary amine catalyst.” Col. 4:65-68 (emphasis added). It would have been an obvious design modification of Dunning to use Dani’s adhesives because both Dunning and Dani are directed to similar decorative laminates for automobile and a person of ordinary skill in the art would have understood that Dani’s polyurethane adhesive would work well with Dunning’s polyurethane layer to which the polyurethane adhesive is attached.

118. In addition, claim 16 is obvious in view of Dunning and Igarashi. Igarashi also discloses the adhesives recited in claim 16. Igarashi discloses an adhesive for plastic films and metalized films. Abstract. *See also* col. 5:46-53. Metals for metallization are aluminum, nickel, chrome and their alloys. Col. 1:8-16. Igarashi’s adhesive includes “. . . (A) a *polyester* polyol, polyester *polyurethane* polyol or their mixture, (B) a silane coupling agent, (C) a vinyl-chloride copolymerization resin, (D) a diene synthetic rubber and (E) an organic polyisocyanate.” Col. 2:3-8 (emphasis added). *See also* Table 1. It would have



been obvious to one of ordinary skill in the art to use Igarashi's adhesive layer in place of Dunning's adhesive layer as a known substitute with a predictable result.

119. Claim 17 is anticipated by Dunning or would have been obvious in view of Dunning alone or in combination with Dani or further in combination with Ohta. Claim 17 recites “. . . the adhesive is a thermally activated adhesive.” Dunning discloses this limitation because it states that “[t]he adherence layer can be a layer of adhesive, such as a pressure-sensitive, or *heat-activated* adhesive.” Col. 2:50-52 (emphasis added). Dani also discloses this limitation because it states that “[t]he polyester-isocyanate adhesive coating 13 may be applied to the primed surface 12 by roller coating at a dry thickness of about 5 to 10 microns and dried at temperatures in the order of 150° to 250° F. (65° to 125° C.). The laminate structure, now comprising the layers 12 and 13 coating the aluminized surface 11 of the polyester film 10, is press laminated to the vinyl film 20 at 175° to 350° F. (80° to 175° C.).” Col. 5:45-52.

120. Claim 18 is anticipated by Dunning or would have been obvious in view of Dunning alone or in combination with Dani and Igarashi or further in combination with Ohta. Claim 18 recites “. . . the adhesive includes two components.” Dunning discloses this limitation because it states that “[a] vinyl coating such as Union Carbide's VMCH vinyl resin (copolymer of 85 to 88% vinyl

chloride, 10.8 to 14.2% vinyl acetate, and 0.8 to 1.2% maleic acid), as well as many acrylic adhesives, can be used.” Col. 5:68-6:4.

121. Further, adhesives including multiple components were well-known in this art, as I explained in the Kuwahara section. For example, both Dani and Igarashi disclosed multi-component adhesives, as explained with respect to claim 16.

122. Claims 19 and 21 would have been obvious in view of Dunning alone or in combination with Dani or Igarashi or further in combination with Ohta. Claim 19 recites “. . . the adhesive includes polyester and isocyanate,” and claim 21 recites “. . . the adhesive includes polyurethane and isocyanate.” The multi-component adhesives recited in claims 19 and 21 were well-known in the art. Both Dani and Igarashi disclose the limitations of claim 19 and the limitations of claim 21, as explained with respect to claim 16.

123. Claim 25 is anticipated by Dunning or would have been obvious in view of Dunning alone or in combination with Ohta. Claim 25 recites “. . . said metal is indium.” Dunning discloses this limitation because it states that “[c]hromium is the preferred metal, although other bright reflective metals capable of being vacuum-deposited can be used, such as nickel; nickel and chromium alloys such as Nichrome; alloys of iron and chromium, or iron, nickel and chromium, such as stainless steel; aluminum; alloys of aluminum, such as

aluminum and chromium; tin; antimony; magnesium; *indium*; silver; platinum; rhodium; and palladium.” Col. 2:6-13 (emphasis added).

124. Claim 26 is anticipated by Dunning or would have been obvious in view of Dunning alone or in combination with Ohta. Claim 26 recites “. . . said metal is selected from the group consisting of zinc, tin, gallium, aluminum, cadmium, copper, nickel, cobalt, iron, stainless steel, gold, platinum, chromium, nichrome, palladium, and rhodium.” Dunning discloses this limitation. *See* the variations of Dunning’s metals described above with respect to claim 25.

125. Claim 27 would have been obvious in view of Dunning alone or in combination with Ohta or further in combination with Dani and Wenrick. Claim 27 recites “. . . at least one of said thermoplastic layers is tinted.” Tinting of a thermoplastic layer was well known in this art.

126. Claim 27 is also obvious in view of Dunning, Dani and Wenrick. Dunning discloses a thermoplastic layer that is placed between the metal layer 18 and the adhesive layer 28 and tinted. Specifically Dunning states:

FIG. 3 shows another alternate embodiment in which the opacity of the metal layer 18 is reinforced by an opaque layer 26 of pigment, such as a black pigment, white pigment, or aluminum flakes in a suitable liquid base coated over the layer 18. Preferably, such a pigmented opaque layer 26 is stretchable in much the same way as the elastomeric film 16. For example, the desired opaque pigment can be dispersed in a layer of a thermoplastic polyurethane coated over the

metal layer 18. The pigment also can be dispersed in a suitable ethylene, vinyl, or acrylic rubber base for coating over the reflective metal layer.

Col. 5:25-36.

127. Dani discloses a molding strip including the laminate film, which is used for a decorative automotive trim. *See* 1:9-12, FIG. 4. The structures of the decorative molding strips for both Dunning and Dani are similar. *See* FIG. 3 of Dunning. Dani further discloses that the molding strip shown in FIG. 4 is described in Wenrick. Col. 8:17-20. Wenrick discloses that:

The trim strip of this invention is a composite trim strip constituted by two longitudinally extending adhesively bonded plastic body portions which are preferably laterally non-coextensive. The first body portion is desirably of narrow width and of a first color, and this first body portion can include contrasting decorative longitudinal side strips. . . .

Wenrick, col. 1:27-32.

128. Adding Wenrick's coloring to Dunning's first thermoplastic layer would have been an obvious design choice to one of ordinary skill in the art because Wenrick discloses that a thermoplastic layer in a three-layer automobile trim may be colored and Dunning teaches a coloring of the automobile strip. Coloring is a variation of tinting. *See* discussion of claim 29 below.