PROTECTED SUBSTRATE AND METHOD FOR PROTECTING A SUBSTRATE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of United States Application No. 17/214,905, filed April 27, 2021, which claims the benefit of United States Provisional Patent Application No. 63/018,596, filed May 1, 2020, which are hereby incorporated by reference in their entirety.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention is directed to protected substrates and to methods for protecting a substrate.

Description of Related Art

[0003] Large substrates, such as large glass sheets, often become damaged during shipment from the manufacturing plant to the customer site. This results in a substrate unsuitable for installation, causing chargebacks to the manufacturer and delay to the construction project. One way to protect large substrates from damage is to overlap, or hold together using tape, two smaller protective sheets positioned over the large substrates.

[0004] This approach includes certain drawbacks. For example, a small capillary tube can be formed at the seam of the two smaller protective sheets over which the tape is applied. The small capillary tube attracts water that induces corrosion at the site of the seam, which results in damage requiring chargebacks and project delays. Therefore, a protected substrate that prevents damage to a large substrate during shipment, including corrosion damage induced at the seam of overlaying protective sheets, is desired.

SUMMARY

[0005] The present disclosure is directed to a protected substrate comprising: a planar substrate comprising a surface; and a burn-off temporary protective layer positioned over at least a portion of the surface, where the burn-off temporary protective layer comprises a polyurethane layer, an epoxide layer, or a combination thereof. The burn-off temporary protective layer may be removable by a heat treatment process that does not substantially damage the surface.

[0005a] In one aspect, the present disclosure is directed to a protected substrate, comprising:

a planar substrate comprising a surface; and

a burn-off temporary protective layer positioned over at least a portion of the surface,

wherein the burn-off temporary protective layer comprises a polyurethane layer, an epoxide layer, or a combination thereof,

wherein the polyurethane layer comprises polyurethane obtained by reacting one or more hydroxyl functional compounds with one or more isocyanate functional compounds, and

wherein the epoxide layer comprises an epoxy functional polymeric material, and

wherein the burn-off temporary protective layer is formed from an emulsion of the polyurethane or epoxy functional polymeric material.

[0006] The present disclosure is also directed to a method for protecting a substrate, comprising: providing a planar substrate comprising a surface; and applying a material to form a burn-off temporary protective layer over at least a first portion of the surface, where the burn-off temporary protective layer comprises a polyurethane layer, an epoxide layer, or a

combination thereof. The burn-off temporary protective layer may be removable by a heat treatment process that does not substantially damage the surface.

[0006a] In another aspect, the present disclosure is also directed to a method for protecting a substrate, comprising:

providing a planar substrate comprising a surface; and

applying a material to form a burn-off temporary protective layer over at least a first portion of the surface,

wherein the burn-off temporary protective layer comprises a polyurethane layer, an epoxide layer, or a combination thereof,

wherein the polyurethane layer comprises polyurethane obtained by reacting one or more hydroxyl functional compounds with one or more isocyanate functional compounds, and

wherein the epoxide layer comprises an epoxy functional polymeric material, and

wherein the burn-off temporary protective layer is formed from an emulsion of the polyurethane or epoxy functional polymeric material.

[0007] The present disclosure is also directed to a method of removing a burn-off temporary protective layer from a coated substrate including: providing a coated substrate including a surface over a portion of which a burn-off temporary protective layer is applied, where the burn-off temporary protective layer comprises a polyurethane layer, an epoxide layer, or a combination thereof; and removing the burn-off temporary protective layer from the surface by burning the burn-off temporary protective layer to form an unprotected substrate. The burn-off temporary protective layer may be removable by a heat treatment process that does not substantially damage the surface.

[0007a] In another aspect, the present disclosure is also directed to a method of removing a burn-off temporary protective layer from a coated substrate, comprising:

providing a coated substrate comprising a surface over a portion of which a burn-off temporary protective layer is applied, wherein the burn-off temporary protective layer comprises a polyurethane layer, an epoxide layer, or a combination thereof; and

removing the burn-off temporary protective layer from the surface by burning the burn-off temporary protective layer to form an unprotected substrate without substantially damaging the surface,

wherein the polyurethane layer comprises polyurethane obtained by reacting one or more hydroxyl functional compounds with one or more isocyanate functional compounds, and

wherein the epoxide layer comprises an epoxy functional polymeric material, and

wherein the burn-off temporary protective layer is formed from an emulsion of the polyurethane or epoxy functional polymeric material.

[0008] The present disclosure is also directed to a protected substrate, including: a planar substrate including a surface; a temporary protective layer positioned over at least a portion of the surface; a first temporary protective sheet positioned over at least a first portion of the surface; and a second temporary protective sheet positioned over at least a second portion the surface, where an overlapping portion of the second temporary protective sheet overlaps an overlapping portion of the first temporary protective sheet at an overlap; where a gap is defined by the overlap between the second temporary protective sheet and a portion of the surface, where a portion of the temporary protective layer is positioned between the second temporary protective sheet and the portion of the surface.

[0009] The present disclosure is also directed to a protected substrate including: a planar substrate including a surface; a first temporary protective sheet positioned over a first portion of the surface; a second temporary protective sheet positioned over a second portion of the surface, where a third portion of the surface is not covered by the first temporary protective sheet and where the third portion of the surface is not covered by the second temporary protective sheet; and a temporary protective layer over at least the third portion of the surface, where the temporary protective layer is positioned directly beneath the first and/or second protective sheet and is positioned between the substrate and the first and/or second temporary protective sheet.

[0010] The present disclosure is also directed to a method for protecting a substrate including: providing a planar substrate including a surface; applying a material to form a temporary protective layer over at least a first portion of the surface; adhering a first temporary protective sheet over a second portion of the surface, where a portion of the first temporary protective sheet overlaps a first portion of the temporary protective layer; and adhering a second temporary protective sheet over a second portion of the temporary protective layer and over a

THE INVENTION CLAIMED IS

1. A protected substrate, comprising:

a planar substrate comprising a surface; and

a burn-off temporary protective layer positioned over at least a portion of the surface,

wherein the burn-off temporary protective layer comprises a polyurethane layer, an epoxide layer, or a combination thereof,

wherein the polyurethane layer comprises polyurethane obtained by reacting one or more hydroxyl functional compounds with one or more isocyanate functional compounds, and

wherein the epoxide layer comprises an epoxy functional polymeric material, and

wherein the burn-off temporary protective layer is formed from an emulsion of the polyurethane or epoxy functional polymeric material.

2. The protected substrate of claim 1, wherein the burn-off temporary protective layer is removable by a heat treatment process that does not substantially damage the surface.

3. The protected substrate of claim 1, wherein the burn-off temporary protective layer comprises a thickness of at least 10 nm and at most 5,000 μm.

4. The protected substrate of claim 1, wherein the protected substrate does not include a temporary protective sheet positioned over the surface.

5. The protected substrate of claim 1, wherein the burn-off temporary protective layer is removable by burning at a temperature of at most 1000°C.

6. The protected substrate of claim 2, wherein the heat treatment process does not cause the surface to have a color change (DECMC) of more than 3 units compared to a color of a surface of an identical planar substrate without the burn-off temporary protective layer after the heat treatment process.

7. The protected substrate of claim 1, wherein the planar substrate comprises glass.

8. The protected substrate of claim 1, wherein the burn-off temporary protective layer is an outermost layer of the planar substrate.

9. The protected substrate of claim 1, further comprising a functional coating positioned between the surface and the burn-off temporary protective layer.

10. The protected substrate of claim 9, wherein the functional coating comprises a low-E coating layer.

11. The protected substrate of claim 1, wherein the burn-off temporary protective layer is UV curable.

12. A method for protecting a substrate, comprising:

providing a planar substrate comprising a surface; and

applying a material to form a burn-off temporary protective layer over at least a first portion of the surface,

wherein the burn-off temporary protective layer comprises a polyurethane layer, an epoxide layer, or a combination thereof,

wherein the polyurethane layer comprises polyurethane obtained by reacting one or more hydroxyl functional compounds with one or more isocyanate functional compounds, and

wherein the epoxide layer comprises an epoxy functional polymeric material, and

wherein the burn-off temporary protective layer is formed from an emulsion of the polyurethane or epoxy functional polymeric material.

13. The method of claim 12, wherein the burn-off temporary protective layer is removable by a heat treatment process that does not substantially damage the surface.

14. The method of claim 12, further comprising applying a functional coating over at least a portion of the substrate and applying the burn-off protective layer over at least a portion of the functional coating.

15. A method of removing a burn-off temporary protective layer from a coated substrate, comprising:

providing a coated substrate comprising a surface over a portion of which a burn-off temporary protective layer is applied, wherein the burn-off temporary protective layer comprises a polyurethane layer, an epoxide layer, or a combination thereof; and

removing the burn-off temporary protective layer from the surface by burning the burn-off temporary protective layer to form an unprotected substrate without substantially damaging the surface,

wherein the polyurethane layer comprises polyurethane obtained by reacting one or more hydroxyl functional compounds with one or more isocyanate functional compounds, and

wherein the epoxide layer comprises an epoxy functional polymeric material, and

wherein the burn-off temporary protective layer is formed from an emulsion of the polyurethane or epoxy functional polymeric material.