

EDGE PROTECTED BARRIER ASSEMBLIES

Background

5 Emerging solar technologies such as organic photovoltaic devices (OPVs) and thin film solar cells like Copper Indium Gallium di-Selenide (CIGS) require protection from water vapor and need to be durable (e.g., to ultra-violet (UV) light) in outdoor environments. Typically, glass has been used as an encapsulating material for such solar devices because glass is a very good barrier to water vapor, is optically transparent, and is stable to UV light. However, glass is heavy,
10 brittle, difficult to make flexible, and difficult to handle. There has been interest in developing transparent flexible encapsulating materials to replace glass that will not share the drawbacks of glass but have glass-like barrier properties and UV stability, and a number of flexible barrier films have been developed that approach the barrier properties of glass.

Solar devices are used outdoors, and so are exposed to the elements, including wind, water
15 and sunlight. Water penetration into solar panels has been a long-standing problem. Solar panels may also be deleteriously affected by wind and sunlight.

Many flexible barrier films are multi-layer film laminates. Any multi-layer film laminate has the potential for delamination, especially at the edges. Reducing delamination at the edges will improve overall performance of the barrier films.

Summary

~~An aspect of the present invention provides~~
25 ~~The present application is directed to an assembly comprising an electronic device, and a multilayer film. The multilayer film comprises a barrier stack adjacent the electronic device, and a weatherable sheet adjacent the barrier stack opposite the electronic device. In specific embodiments, the multilayer film comprises a substrate adjacent the electronic device, a barrier stack adjacent the substrate opposite the electronic device, and a polymer weatherable sheet adjacent the barrier stack opposite the substrate. The multilayer film is transparent and flexible and the barrier stack and the substrate are insulated from the environment.~~

Detailed Description

Edge delamination is a concern for multi-layer films. Slight edge delamination may cause separation of the multiple layers. It has been found that delamination can be controlled by the assessment, control and modification of three inputs. The first input that is assessed is the
35 exposure to light at the interface. The light exposure encompasses visible light in addition to ultraviolet light. Water exposure is the second input. The third input is the stress on an interface. Modification and control of these three input values will maintain a peel of greater than 20

Pending Claims

What is claimed is:

1. ~~(Previously Presented)~~—An assembly comprising an electronic device, and a multilayer film, the multilayer film comprising:
 - a substrate adjacent the electronic device;
 - a barrier stack adjacent the substrate opposite the electronic device; and
 - a polymer weatherable sheet adjacent the barrier stack opposite the substrate,wherein the multilayer film is transparent and flexible and the barrier stack and the substrate are insulated from the environment.
2. ~~(Original)~~ The assembly of claim 1 wherein the barrier stack comprises a polymer layer and an inorganic barrier layer.
3. ~~(Original)~~ The assembly of claim 2 wherein the inorganic barrier layer is an oxide layer.
4. ~~(Original)~~ The assembly of claim 1 wherein the substrate comprises at least one of polyethylene terephthalate, polyethylene naphthalate, polyetheretherketone, polyaryletherketone, polyacrylate, polyetherimide, polyarylsulfone, polyethersulfone, polyamideimide, or polyimide.
5. ~~(Original)~~ The assembly of claim 1 wherein the weatherable sheet comprises a fluoropolymer.
6. ~~(Original)~~ The assembly of claim 5 wherein the fluoropolymer comprises at least one of an ethylene tetrafluoro-ethylene copolymer, a tetrafluoroethylene-hexafluoropropylene copolymer, a tetrafluoroethylene-hexafluoropropylene-vinylidene fluoride copolymer, or a polyvinylidene fluoride.
7. ~~(Original)~~ The assembly of claim 1 comprising a pressure sensitive adhesive layer between the weatherable sheet and the barrier stack.
8. ~~(Original)~~ The assembly of claim 7 wherein the pressure sensitive adhesive is an acrylate, a silicone, a polyisobutylene, a urea or a blend thereof.
9. ~~(Original)~~ The assembly of claim 7 wherein the pressure sensitive adhesive comprises at least one of a UV stabilizer, a hindered amine light stabilizer, an antioxidant or a thermal stabilizer.

10. ~~(Original)~~ The assembly of claim 1 wherein the electronic device comprises an encapsulant layer adjacent the substrate.
11. ~~(Original)~~ The assembly of claim 1 wherein the electronic device comprises an edge seal.
12. ~~(Original)~~ The assembly of claim 1 wherein the barrier stack oxide layer shares a siloxane bond with the barrier stack polymer layer.
13. ~~(Original)~~ The assembly of claim 1 wherein the barrier stack and the substrate are covered by a different material.
14. ~~(Original)~~ The assembly of claim 1 wherein the barrier stack and the substrate edges are modified to insulate them from the environment.
15. ~~(Original)~~ The assembly of claim 1 wherein the electronic device is a photovoltaic cell.
16. ~~(Original)~~ The assembly of claim 15 wherein the photovoltaic cell is a CIGS cell.
17. ~~(Original)~~ The assembly of claim 1 wherein the substrate is heat stabilized.
18. ~~(Original)~~ The assembly of claim 1 wherein the barrier stack has a water vapor transmission rate of less than 0.005 cc/m²/day at 50°C and 100% relative humidity.
19. ~~(Original)~~ The assembly of claim 1 wherein the barrier stack has an oxygen transmission rate of less than 0.005 cc/m²/day at 23°C and 90% relative humidity.
20. ~~(Original)~~ The assembly of claim 1 wherein the barrier stack comprises at least two oxide layers.
21. ~~(Original)~~ The assembly of claim 1 wherein the barrier stack comprises at least two polymers layers.
22. ~~(Original)~~ The assembly of claim 1 wherein the electronic device comprises a backsheet.
23. ~~(Original)~~ The assembly of claim 1 wherein the electronic device comprises a roof.