CLAIMS

1. An outdoor display device, comprising:

A liquid crystal panel, and

A multilayer optical film, the multilayer optical film located between the liquid crystal panel and an intended viewer, such that light incident upon the device is first incident upon the multilayer optical film,

Wherein the multilayer optical film comprises UV stable material, such that the multilayer optical film is capable of sustainable outdoor use;

wherein the film transmits over 60% of a short range visible band of light at a 60 degree angle of incidence through to the liquid crystal panel, and the film reflects an average of at least a majority of a large LC destructive band at a 60 degree angle of incidence;

And further wherein the film transmits over 70% of a long range visible band of light at normal incidence through to the liquid crystal panel.

2. The outdoor display device of claim 1, wherein the large LC destructive visible band is light of wavelengths between about 600 and 800nm.

3. The display device of claim 2, wherein the multilayer optical film reflects an average of at least about 75% of the LC destructive band at a 60 degree angle of incidence.

4. The display device of claim 1, wherein the LC destructive band is light of wavelengths between about 570nm and about 900nm.

5. The display device of claim 4, wherein the multilayer optical film reflects an average of at least about 97% of the LC destructive band at a 60 degree angle of incidence.

6. The display device of claim 1, wherein the UV stable material comprises PET/coPMMA.

7. The display device of claim 1, wherein the device maintains a b* yellowness index of less than 5 for at least 5 years.

8. The display device of claim 1, wherein the display device further comprises an outermost surface, the outermost surface comprising a hard coat.

9. The display device of claim 8, wherein the hard coat is anti-reflective.

10. The display device of claim 8, wherein the hard coat absorbs at least 98% of UV light having a wavelength of between about 250nm and about 380nm.

11. A method for reducing sun damage to a liquid crystal panel, comprising:

Directly applying a multilayer optical film to the liquid crystal panel that reflects a majority of light having a wavelength of between about 600 nm and about 800 nm at a 60 degree angle of incidence, transmits over 70% of light having a wavelength of between about 420nm and about 550 nm from a light input surface of the film through to the liquid crystal panel at a 60 degree angle of incidence, and transmits over 70% of light having a wavelength of between about 420nm and about 650nm from the input surface through to the liquid crystal panel at normal incidence.

12. The method of claim 11, wherein the multilayer optical film reflects or absorb at least 90% of light having a wavelength of between about 600nm and about 800nm at a 60 degree angle of incidence.

13. The method of claim 11, wherein the multilayer optical film applied to the liquid crystal panel reflects or absorbs an average of at least about 97% of light having a wavelength of between about 570nm and about 900nm at a 60 degree angle.

14. A display device, comprising:

A liquid crystal panel;

A multilayer polymeric film optically coupled to the liquid crystal panel; and

A metal layer optically coupled to the multilayer polymeric film and liquid crystal panel; and

At least one metal oxide layer, the metal oxide layer disposed on a surface of the metal layer;

Wherein a majority of light having a wavelength of between about 420nm and about 650nm that is incident on the multilayer polymeric film at a normal angle is transmitted, and a majority of light having a wavelength of between about 420 nm and about 550 nm that is incident on the multilayer polymeric film at a 60 degree incidence angle is transmitted, and a majority of light having a wavelength between about 600 nm and about 800 nm is reflected at a 60 degree incidence angle.

15. The display device of claim 14, wherein at least 75% of light having a wavelength of between about 600 and 800nm that is incident on the multilayer polymeric film at a 60 degree incidence angle is reflected.

16. The display device of claim 14, wherein at least 90% of light having a wavelength of between about 570nm and about 900nm that is incident on the multilayer polymeric film at a 60 degree incidence angle is reflected.

17. The display device of claim 14, wherein at least 60% of light having a wavelength of between about 420nm and about 550nm that is incident on the multilayer polymeric film at a 60 degree incidence angle is transmitted.

18. The display device of claim 14, wherein the metal layer and metal oxide layer are positioned between the liquid crystal panel and the multilayer polymeric film.

19. The display device of claim 14, wherein the metal layer and metal oxide layer are positioned on the opposite surface of the multilayer polymeric film from the liquid crystal panel.

20. The display device of claim 14, wherein the outermost surface comprises a hard coat.

21. The display device of claim 14, wherein the hard coat is anti-reflective.

22. The display device of claim 20 wherein the hard coat absorbs at least 98% of UV light having a wavelength of between about 250nm to about 380nm.

CLAIMS

1. An outdoor display device, comprising:

a liquid crystal panel, and

a multilayer optical film, the multilayer optical film located between the liquid crystal panel and an intended viewer, such that light incident upon the device is first incident upon the multilayer optical film,

wherein the multilayer optical film comprises UV stable material, such that the multilayer optical film is capable of sustainable outdoor use;

wherein the film transmits over 60% of a short range visible band (i.e 420-550nm) of light at a 60 degree angle of incidence through to the liquid crystal panel, and the film reflects an average of at least a majority of a large LC destructive band (i.e 570-900nm) at a 60 degree angle of incidence;

and further wherein the film transmits over 70% of a long range visible band (i.e 420-650nm) of light at normal incidence through to the liquid crystal panel.

2. The device according to claim 1, wherein the large LC destructive visible band is light of wavelengths between about 600 and 800nm.

3. The device according to claim 2, wherein the multilayer optical film reflects an average of at least about 75% of the LC destructive band at a 60 degree angle of incidence.

4. The device according to claim 1, wherein the multilayer optical film reflects an average of at least about 97% of the LC destructive band at a 60 degree angle of incidence.

5. The device according to claim 1, wherein the UV stable material comprises PET/coPMMA.

6. The device according to claim 1, wherein the device maintains a b* yellowness index of less than 5 for at least 5 years.

7. The device according to claim 1, wherein the display device further comprises an outermost surface, the outermost surface comprising a hard coat.

8. The device according to claim 7, wherein the hard coat is anti-reflective.

9. The device according to claim 7, wherein the hard coat absorbs at least 98% of UV light having a wavelength of between about 250nm and about 380nm.

10. A method for reducing sun damage to a liquid crystal panel, comprising:

directly applying a multilayer optical film to the liquid crystal panel that reflects a majority of light having a wavelength of between about 600 nm and about 800 nm at a 60 degree angle of incidence, transmits over 70% of light having a wavelength of between about 420nm and about 550 nm from a light input surface of the film through to the liquid crystal panel at a 60 degree angle of incidence, and transmits over 70% of light having a wavelength of between about 420nm and about 650nm from the input surface through to the liquid crystal panel at normal incidence.

11. The method according to claim 10, wherein the multilayer optical film reflects or absorb at least 90% of light having a wavelength of between about 600nm and about 800nm at a 60 degree angle of incidence.

12. The method according to claim 10, wherein the multilayer optical film applied to the liquid crystal panel reflects or absorbs an average of at least about 97% of light having a wavelength of between about 570nm and about 900nm at a 60 degree angle.

13. A display device, comprising:

a liquid crystal panel;

a multilayer polymeric film optically coupled to the liquid crystal panel; and

a metal layer optically coupled to the multilayer polymeric film and liquid crystal panel; and

at least one metal oxide layer, the metal oxide layer disposed on a surface of the metal layer;

wherein a majority of light having a wavelength of between about 420nm and about 650nm that is incident on the multilayer polymeric film at a normal angle is transmitted, and a majority of light having a wavelength of between about 420 nm and about 550 nm that is incident on the multilayer polymeric film at a 60 degree incidence angle is

transmitted, and a majority of light having a wavelength between about 600 nm and about 800 nm is reflected at a 60 degree incidence angle.

14. The device according to claim 13, wherein at least 75% of light having a wavelength of between about 600 and 800nm that is incident on the multilayer polymeric film at a 60 degree incidence angle is reflected.

15. The device according to claim 13, wherein at least 90% of light having a wavelength of between about 570nm and about 900nm that is incident on the multilayer polymeric film at a 60 degree incidence angle is reflected.

16. The device according to claim 13, wherein at least 60% of light having a wavelength of between about 420nm and about 550nm that is incident on the multilayer polymeric film at a 60 degree incidence angle is transmitted.

17. The device according to claim 13, wherein the metal layer and metal oxide layer are positioned between the liquid crystal panel and the multilayer polymeric film.

18. The device according to claim 13, wherein the metal layer and metal oxide layer are positioned on the opposite surface of the multilayer polymeric film from the liquid crystal panel.

19. The device according to claim 13, wherein the outermost surface comprises a hard coat.

20. The device according to claim 13, wherein the hard coat is anti-reflective.

21. The device according to claim 19, wherein the hard coat absorbs at least 98% of UV light having a wavelength of between about 250nm to about 380nm.