CLAIMS

1. A system, comprising:

a power source;

a multi-layer device connected to the power source and having two sides: a viewing side and a second side opposite the viewing side, the multi-layer device permitting or preventing light to pass therethrough from the second side toward the viewing side, the multi-layer device comprising:

a coloring layer group having a plurality of pixels, each pixel having at least one sub-pixel corresponding to white or to at least one color; and

a shutter layer group having a unique sub-pixel corresponding to each sub-pixel of the coloring layer group; and

an electronic controller connected to the power source and the multi-layer device, and configured to:

control each shutter layer group sub-pixel to selectively permit or prevent passage of an amount of light therethrough to produce a pixel that ranges from transparent to opaque black; and

control each combination of coloring layer group sub-pixel and corresponding shutter layer group sub-pixel to produce a pixel on the viewing side that can be each of the following: transparent, transparent color or colors, transparent white, at least substantially opaque color or colors, at least substantially opaque white, opaque color or colors, opaque white, and opaque black.

2. The system according to claim 1, wherein the coloring layer group comprises an active light coloring emitter; and

wherein the electronic controller controls each combination of coloring layer group sub-pixel and corresponding shutter layer group sub-pixel to produce pixels on the viewing side that can range from transparent to each of the following: transparent color or colors, transparent white, at least

substantially opaque color or colors, at least substantially opaque white, opaque color or colors, opaque white, and opaque black.

3. The system according to claim 2, wherein the active light coloring emitter comprises one of:

an organic light emitting diode; or
quantum dots on a substrate.

4. The system according to claim 1, wherein the shutter layer group comprises one of:

a liquid crystal layer;

E-ink disposed between substrates;

a suspended particle device (SPD) disposed on a substrate;

microblinds disposed on a substrate;

nanocrystals embedded in glass;

quantum dots disposed on a substrate; or

an electrochromic coating disposed on a substrate.

5. The system according to claim 1, wherein the multi-layer device further comprises:

a diffusing layer group having a unique sub-pixel corresponding to each sub-pixel of the coloring layer group; and

wherein the electronic controller is configured to:

control each diffusing layer group sub-pixel to produce a pixel that ranges from transparent to substantially opaque white; and

control each combination of coloring layer group sub-pixel and corresponding shutter layer group sub-pixel to produce pixels on the viewing side that can range from transparent to each of the following: transparent color or colors, transparent white, at least substantially opaque color or colors, at least substantially opaque white, opaque color or colors, opaque white, and opaque black.

6. The system according to claim 2 or 5, wherein the coloring layer group comprises a plurality of pixels, each pixel having at least more than one sub-pixel corresponding to a color.

7. The system according to claim 2 or 5, wherein the coloring layer group comprises a plurality of pixels, each pixel having at least three sub-pixels corresponding to different colors.

8. The system according to claim 7, wherein three of the sub-pixels are red, green and blue.

9. The system according to claim 1 or 5, wherein the coloring layer group comprises a passive color filter.

10. The system according to claim 5, wherein the diffusing layer group comprises one of:

a polymer dispersed liquid crystal (PDLC) layer; or

a suspended particle device (SPD).

11. The system according to claim 1, wherein the power source:

is one of:

AC power;

a transparent photovoltaic layer;

a non-transparent photovoltaic cell; or

one or more batteries; or

charges rechargeable batteries.

12. A method of producing an image on a viewing side of a multi-layer device, the multi-layer device being connected to a power source and also having a viewing side and a second side opposite the viewing side, the multi-layer device permitting or preventing passage of light therethrough toward the viewing side, the multi-layer device comprising a coloring layer group having a plurality of pixels, each pixel having at least one sub-pixel corresponding to a white or at least one color; and a shutter layer group having a unique sub-pixel corresponding to each sub-pixel of the coloring layer group; the method comprising:

with an electronic controller:

controlling each shutter layer group sub-pixel to produce a pixel that ranges from transparent to opaque black; and

controlling each combination coloring layer group sub-pixel and corresponding shutter layer group sub-pixel to produce a pixel on the viewing side that can be each of the following: transparent, transparent color or colors, transparent white, at least substantially opaque color or colors, at least substantially opaque white, opaque color or colors, opaque white, and opaque black.

13. The method according to claim 12, wherein the coloring layer group comprises an active light coloring emitter; and

wherein the method further comprises:

with the electronic controller, controlling each combination of coloring layer group sub-pixel and corresponding shutter layer group sub-pixel to produce pixels on the viewing side that can range from transparent to each of the following: transparent color or colors,

transparent white, at least substantially opaque color or colors, at least substantially opaque white, opaque color or colors, opaque white, and opaque black.

14. The method according to claim 12, wherein the multi-layer device further comprises a diffusing layer group having a unique sub-pixel corresponding to each sub-pixel of the coloring layer group; and

wherein the method further comprises:

with the electronic controller:

controlling each diffusing layer group sub-pixel to produce a pixel that ranges from transparent to substantially opaque white; and

controlling each combination of coloring layer group sub-pixel and corresponding shutter layer group sub-pixel to produce pixels on the viewing side that range from transparent to each of the following: transparent color or colors, transparent white, at least substantially opaque color or colors, at least substantially opaque white, opaque color or colors, opaque white, and opaque black.

15. The method according to claim 14, wherein the coloring layer group comprises a passive color filter.