

- [0062] 13 transparent electrode layer
- [0063] 14 organic layer(s)
- [0064] 15 reflective electrode layer
- [0065] 16 reflective electrode
- [0066] 18 transparent low-index element
- [0067] 19 gap
- [0068] 20 encapsulating cover
- [0069] 21 anti-reflection layer
- [0070] 22 scattering layer
- [0071] 24 scattering particles
- [0072] 24 raised area
- [0073] 25 scattering reflective electrode surface
- [0074] 27 scattering refractive electrode surface
- [0075] 29 short reduction layer
- [0076] 30, 32, 34, 36, 38 pixels
- [0077] 31 layer of encapsulating material

1. An organic light-emitting diode (OLED) device, comprising:

a substrate;

an OLED comprising first and second electrodes and one or more layers of organic light-emitting material formed between the electrodes, wherein at least one electrode comprises a transparent electrode, the transparent electrode and layer(s) of organic light-emitting material having a first refractive index range; and

an encapsulating cover; wherein at least one of the substrate or cover comprises a transparent substrate or cover having a second refractive index and through which light from the OLED is emitted;

and further comprising a light scattering layer located between the substrate and cover, and a transparent low-index element having a third refractive index lower than each of the first refractive index range and second refractive index and located between the scattering layer and the transparent substrate or cover.

2. The OLED device of claim 1, wherein the scattering layer is located between the substrate and an electrode, between an electrode and the layer(s) of organic material, or between an electrode and the cover.

3. The OLED device of claim 1, wherein the scattering layer is adjacent to and in contact with an electrode.

4. The OLED device of claim 1, wherein the cover is a transparent cover through which light from the OLED is emitted, and wherein the transparent low-index element is adjacent to and in contact with the cover.

5. The OLED device of claim 4, wherein the transparent low-index element comprises a solid layer, void or gap between the OLED and the cover.

6. The OLED device of claim 5, wherein the transparent low-index element comprises a gap filled with air or an inert gas.

7. The OLED device of claim 4, wherein the OLED comprises a first reflective electrode formed over the substrate, and a transparent second electrode formed over the

layer(s) of organic light-emitting material, and the scattering layer is located over the transparent electrode.

8. The OLED device of claim 7, further comprising a protective layer formed between the second transparent electrode and the scattering layer.

9. The OLED device of claim 4, wherein the OLED comprises a first transparent electrode formed over the substrate, and a transparent second electrode formed over the layer(s) of organic light-emitting material, and the scattering layer is between the first transparent electrode and the substrate.

10. The OLED device of claim 9, further comprising a protective layer formed over the second transparent electrode.

11. The OLED device of claim 1, wherein the substrate is a transparent substrate through which light from the OLED is emitted, and wherein the transparent low-index element is adjacent to and in contact with the substrate.

12. The OLED device of claim 11, wherein the OLED comprises a first transparent electrode formed over the substrate, and a reflective second electrode formed over the layer(s) of organic light-emitting material, and the scattering layer is located over the transparent low-index element and adjacent to and in contact with the transparent electrode.

13. The OLED device of claim 1, wherein the transparent low-index element comprises a solid layer of optically transparent material.

14. The OLED device of claim 1, wherein the transparent low-index element comprises a void or gap filled with an optically transparent gas or liquid material.

15. The OLED device of claim 1, wherein the light scattering layer is an electrode.

16. The OLED device of claim 1, wherein at least one electrode comprise multiple layers.

17. The OLED device of claim 16, wherein the electrode comprising multiple layers includes a transparent layer and a reflective layer.

18. The OLED device of claim 17, wherein the light scattering layer is located between the transparent layer and the reflective layer of the multiple layer electrode.

19. The OLED device of claim 17, wherein the light scattering layer is the reflective layer of the multiple layer electrode.

20. The OLED device of claim 17, wherein the transparent layer of the multiple layer electrode is electrically conductive.

21. The OLED device of claim 1, wherein the transparent low-index element is greater than 1 micrometer thick.

22. The OLED device claimed in claim 1, wherein the cover is a transparent cover through which light from the OLED is emitted, and the transparent low-index element is adjacent to and in contact with the cover, further comprising raised areas extending above the surface of the OLED and in contact with the cover.

23. The OLED device of claim 22, wherein the OLED is an active-matrix device, and the raised areas comprise patterned insulative layer materials.

24. The OLED device of claim 1, wherein the OLED is a display device.

25. The OLED device of claim 1, wherein the scattering layer includes at least one material having a refractive index equal to or greater than the first refractive index range.