OLED DEVICE

FIELD OF THE INVENTION

[0001] The present invention relates to OLED devices and, more particularly, to OLED devices having a curved format.

BACKGROUND OF THE INVENTION

[0002] Light-emissive devices are well known and used for a wide variety of purposes, including area illumination and the representation of information. Traditionally, these light emissive devices rely on evacuated glass enclosures within which are special gases, phosphors, or filaments that emit light upon the application of a current or when stimulated with an electron. More recently, solid-state light-emissive devices have created a robust, long-lived, and practical light source using, for example, light emitting diodes, liquid crystal displays, and plasma displays.

[0003] Light emissive devices are useful in a variety of forms. Traditional forms include bulbs rounded in one or two dimensions, for example incandescent and fluorescent light bulbs. Neon lighting is often linear and is used to create lines of light through three dimensions. Large-format information displays such as cinemas rely upon curved screens to maintain a constant focal distance for viewers and to more readily simulate a real-world environment. Hence, conventional light-emissive and display devices are found with a variety of shapes, including flat, curved in one or two dimensions, and linear.

[0004] Conventional high-output light-emitting solid-state displays utilize light emitting diodes, typically point sources mounted into a substrate. Because individual devices are individually mounted, these devices can be mounted into a variety of substrates with a variety of shapes. However, because these devices utilize a collection of point light sources, they require additional optical devices such as mirrors and lenses for suitable area illumination. When applied to information display, individually mounted light emitting diodes are expensive and only suitable for low-resolution displays.

[0005] Flat-panel solid-state information display devices such as liquid crystal OLED and plasma display devices provide good resolution but are built upon flat panels, typically glass or silicon, and are not readily applied to curved displays.

[0006] The use of flexible substrates for displays, typically plastic, is also known. However, the quality, efficiency, and resolution of these displays is limited, as is their lifetime.

[0007] There is a need therefore for improved solid-state light emissive devices having a curved substrate for large-area illumination or information presentation.

SUMMARY OF THE INVENTION

[0008] The need is met according to the present invention by a method of making an OLED device that includes the steps of: providing a curved, rigid substrate; and forming one or more OLED elements on the substrate.

ADVANTAGES

[0009] The present invention has the advantage that it can provide an OLED device having a curved surface. The curved surface may be employed in an area illumination light source to improve the light distribution from the light source, or in a display that reduces the apparent distortion of an image on the display.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] **FIG. 1** is a schematic diagram of a prior art OLED;

[0011] **FIG. 2** is a partial cross section of a prior art OLED device having a planar substrate;

[0012] **FIG. 3** is a schematic diagram illustrating the arrangement of electrodes in a prior art passive matrix OLED display device;

[0013] **FIG. 4** is a schematic diagram illustrating a prior art technique for depositing OLED materials on a planar substrate using a linear source;

[0014] **FIG. 5** is a schematic diagram illustrating an OLED display device having a rigid curved substrate according to the present invention;

[0015] **FIG. 6** is a schematic diagram illustrating a method of depositing OLED materials on the inside of a curved substrate according to one embodiment of the present invention;

[0016] **FIG. 7** is a schematic diagram illustrating a method of depositing OLED materials on the outside of a curved substrate according to one embodiment of the present invention;

[0017] **FIG. 8** is an illustration of an OLED display on a curved substrate employed as a computer monitor according to the present invention; and

[0018] **FIG. 9** is a schematic cross section of an OLED according to the prior art.

DETAILED DESCRIPTION OF THE INVENTION

[0019] Referring to **FIG. 1, a** prior art OLED element includes an organic light-emitting layer **12** disposed between two electrodes **14** and **16**, e.g. a cathode and an anode. The organic electro-luminescent layer **12** emits light upon application of a voltage from a power source **18** across the electrodes. The OLED element typically includes a substrate **20** such as glass or plastic. It will be understood that the relative locations of the anode and cathode may be reversed with respect to the substrate. The light-emitting layer **12** may include other layers such as electron or hole injection layers as is known in the art.

[0020] Referring to **FIG. 2, a** prior-art passive-matrix OLED display device **10** includes a planar substrate **20**, upon the edge of which may be located driver circuits **22** that provide signals to OLED elements. A pattern of first electrodes **16** provide conduction to individual OLED elements **12**R, **12**G, **12**B that emit different colors of light, for example red, green, and blue. Taken together, the OLED elements **12**R, **12**G, and **12**B are designated as **12**. A pattern of second electrodes **14** provides conduction to complete an electrical circuit for providing power to the OLED elements **12**. The layers **12**, **14**, and **16** are encapsulated with a hermetically sealed encapsulating cover **32** or an encapsu-