

pixel region adhesion layer and peripheral region adhesion layer to be 10° C. or more, it is possible to maintain the hardness of the peripheral region adhesion layer **1001** at higher temperatures, and protect the edges of the readily breakable thin glass layer **105** against cracking.

[0135] Accordingly, as shown in **FIG. 15**, even when this display device is bent to form a curved surface having a radius R of curvature of about 50 mm to 150 mm, no cracks are formed in either the pixel region or peripheral region. The weight can be reduced because the thickness of the plastic substrate and thin glass layer having the adhesion layer sandwiched between them is about 0.1 mm. Since the thin glass layer exists, the active element circuit region is damaged little, and permeation of water and gas such as oxygen can be prevented, so good element characteristics can be obtained.

[0136] Also, when the display device is bent, tensile stress is produced on the convex surface, and compression stress is produced on the concave surface, so a plane having zero stress is formed between the two surfaces. In this embodiment, the first and second thin glass layers are formed between the first and second plastic substrates. Therefore, the zero stress plane can be formed substantially between the first thin glass layer and second thin glass layer. This improves the bending strength of the display.

[0137] In the above embodiment, an active matrix in which one pixel is made up of one switching transistor, pixel electrode, and capacitive element is explained. However, the present invention is also applicable to a display device which reduces the power consumption by using a memory circuit (flip-flop; SRAM type, storage capacitor and driver transistor: DRAM type) for each pixel.

[0138] Furthermore, a control circuit, CPU, memory, and the like may be integrated in addition to the scanning line and signal line drivers. These circuits, display electrodes, and the like can be collectively regarded as the components of the active element circuit region **102**. Although these circuits inevitably require micropatterning, the use of the non-alkaline glass substrate which deforms little and has high processing accuracy allows formation of high-performance highly integrated circuits.

[0139] (Second Embodiment)

[0140] **FIG. 16A** is a plan view of an active matrix type display device according to the second embodiment. **FIG. 16B** is a sectional view taken along a line **16B-16B** in **FIG. 16A**. In this second embodiment, only a difference from the first embodiment will be explained, and a description of similar parts will be omitted. This applies to each embodiment to be described later.

[0141] In the active matrix type display device of this embodiment, an adhesion layer is uniformly formed from one type of material. The difference from the first embodiment is that each of first and second plastic substrates **104** and **107** is separated into a pixel region plastic substrate **1102** and a peripheral region plastic substrate **1101** formed around the pixel region plastic substrate **1102**. The linear expansion coefficient of the pixel region plastic substrate **1102** is 30 ppm/° C. (inclusive) to 300 ppm/° C. (inclusive). The linear expansion coefficient of the peripheral region plastic substrate **1101** is 1 ppm/° C. (inclusive) to 30 ppm/° C. (inclusive), which is about 2/3 or less that of the pixel region plastic substrate **1102**.

[0142] Between the pixel region plastic substrate **1102** and the peripheral region plastic substrate **1101** around the pixel region plastic substrate **1102**, a slight spacing is desirably formed as a margin against extension.

[0143] The pixel region plastic substrate **1102** can be made of, e.g., PES, polycarbonate, polyolefin-based resin (e.g., Zeonor, cycloolefin polymer, produced by Zeon Corporation), acrylic resin, polypropylene, polyester, or polyethylene, and can have a thickness of about 10 μm to 200 μm. The peripheral region plastic substrate **1101** can be made of, e.g., PEN (PolyEthylene Naphthalate), polyethyleneterephthalate (PET), polyimide, filler-mixed epoxy resin, polyetheretherketone (PEEK), polysulfone (PSF), or polyetherimide (PEI), and can have a thickness of about 50 μm to 200 μm.

[0144] Even when a material having a large linear expansion coefficient is used, this linear expansion coefficient can be decreased by mixing fillers such as silica or alumina, so the material can be used as the peripheral region plastic substrate **1101**. This peripheral region plastic substrate **1101** can be an opaque substrate because it does not participate in display.

[0145] The pixel region plastic substrate **1102** and peripheral region plastic substrate **1101** can have the same thickness, or the peripheral region plastic substrate **1101** can be thicker. When the peripheral region plastic substrate **1101** is made thicker, the peripheral region becomes hard to bend. This prevents stress concentration to a thin glass layer **105** in this peripheral region and thus effectively makes this thin glass layer **105** difficult to break.

[0146] In this embodiment, a PES film having a linear expansion coefficient of about 46 ppm/° C. is used as the pixel region plastic substrate **1102**, and a PEN film having a linear expansion coefficient of about 11 ppm/° C. is used as the peripheral region plastic substrate **1101**.

[0147] In this embodiment, after an element circuit region is formed on substrates such as non-alkaline glass substrates which are highly resistant against heat, these substrates are thinned and bonded to plastic substrates which are light in weight. The linear expansion coefficient of the pixel region plastic substrate is made as large as about 30 ppm/° C. (inclusive) to 300 ppm/° C. (inclusive). The linear expansion coefficient of the peripheral region plastic substrate is made as small as 1 ppm/° C. (inclusive) to 30 ppm/° C. (exclusive), which is 2/3 or less that of the pixel region plastic substrate.

[0148] If the linear expansion coefficient of the pixel region plastic substrate is less than 30 ppm/° C., this linear expansion coefficient is too small, so the display device cannot be flexibly bent. If this linear expansion coefficient is more than 300 ppm/° C., the difference from the linear expansion coefficient of the thin glass layer becomes too large. This applies stress to the thin glass layer when the temperature changes.

[0149] If the linear expansion coefficient of the peripheral region plastic substrate is less than 1 ppm/° C., stress acting on the thin glass layer cannot be reduced, so not only this thin glass layer but also the peripheral region plastic substrate may break. If this linear expansion coefficient is more than 30 ppm/° C., the difference from the linear expansion coefficient of the thin glass layer becomes too large. This allows easy cracking when heat is abruptly applied upon