[0097] (Transparent Conductive Layer)

[0098] Next, the transparent conductive layer **4** will be explained.

[0099] The transparent conductive layer **4** is a deposited film formed by depositing or sputtering a conductive metal or metal oxide.

[0100] To form the transparent conductive layer **4** as a deposited film, indium tin oxide (ITO), antimony-doped tin oxide (ATO), fluorine-doped tin oxide (FTO), aluminum-doped zinc oxide (AZO), or a double oxide consisting of indium oxide and zinc oxide, for example, may be used. It is preferable to form, as the transparent conductive layer, a thin film having a thickness of approximately 40 to 100 nm by vacuum deposition, sputtering or the like, using any of the above-described materials.

[0101] (Other Layers)

[0102] To use the transparent conductive film **1** according to this embodiment by placing it on the observational side of a display, it is preferable to form an anti-reflection layer on the outermost surface of the transparent conductive film **1** to protect reflection of light. Known anti-reflection layers are of single-layer type and multi-layer type. A common anti-reflection layer of multi-layer type is an anti-reflection layer consisting of high-refractive-index layers and low-refractive-index layers that are alternately laminated. The anti-reflection layer can be formed by vacuum deposition, sputtering or the like, where ITO, titanium dioxide, ZrO_2, etc. may be used to form high-refractive-index layers, while SiO_2, MgF_2, fluororesins, silicone resins, etc. may be used to form low-refractive-index layers.

[0103] The transparent conductive film **1** according to this embodiment may be subjected to antistatic treatment so that dusts will not stick to the transparent conductive film **1** during use. Furthermore, the surface of the transparent conductive film **1** on which the fine irregularities are not provided may be subjected to stickiness-imparting treatment by taking convenience upon use into consideration.

[0104] Specifically, the antistatic treatment can be carried out by the use of an antistatic agent or antistatic fine particles, which may be added to a coating composition for forming the fine irregularity layer **3** or the transparent hard coat layer **5**. Alternatively, the antistatic treatment may be conducted by coating the fine irregularity layer **3** with an antistatic agent itself.

[0105] The stickiness-imparting treatment may be conducted by directly applying a polyacrylate or rubber-type pressure-sensitive adhesive. Alternatively, the stickiness-imparting treatment may also be conducted by laminating release paper coated with a pressure-sensitive adhesive. In this case, in order not to bare the pressure-sensitive adhesive layer to prevent the pressure-sensitive adhesive layer from sticking to other objects or protect the pressure-sensitive adhesive layer from dusts, it is better not to peel off the release paper stuck to the transparent conductive film through the pressure-sensitive adhesive layer until the pressure-sensitive adhesive layer is used. It is preferable that the thickness of the pressure-sensitive adhesive layer be from approximately 20 to 40 μm.

[0106] The transparent conductive film **1** according to this embodiment may be provided with a transparent hard coat layer **5** as mentioned previously. The same material as that used to form the aforementioned fine irregularity layer **3** may be used to form the transparent hard coat layer **5**. The transparent hard coat layer **5** can be formed by applying such a material by a proper coating method and curing the material by the application of ionizing radiation such as ultraviolet light or an electron beam. The surface of the transparent conductive film **1** on which the transparent hard coat layer **5** is formed can show improved physical and chemical properties. In the case where the transparent conductive layer **4** is laminated to the fine irregularity layer **3** formed on the surface of the transparent plastic film **2**, the properties (especially, the physical strength) of the surface of the transparent conductive layer **4** are determined by the underlying fine irregularity layer **3**.

[0107] (Touch Panel)

[0108] The transparent conductive films **1** according to this embodiment can be used as electrode sheets for display panels of various modes, or for touch panels to be placed on the surfaces of displays.

[0109] **FIG. 6** is a view showing an example of the application of the transparent conductive film **1** according to this embodiment, to a touch panel. As shown in this figure, a touch panel **20** is composed of a pair of electrode sheets **1**A and **1**B arranged with a spacer **21** interposed between them so that transparent conductive layers **4** and **4'** serving as electrode layers, contained in the electrode sheets **1**A and **1**B, respectively, can face each other with an extremely small gap between them.

[0110] The electrode sheet **1**A arranged on the observational side has the same construction as that of the transparent conductive film **1** shown in **FIG. 2**, and contains a transparent hard coat layer **5**, a transparent plastic film **2**, a fine irregularity layer **3** and a transparent conductive layer **4** in the order stated, the transparent hard coat layer **5** being the top-most layer on the observational side. On the other hand, the electrode sheet **1**B arranged on the back side is composed of a transparent plastic film **2'** and a transparent conductive layer **4'** laminated thereto, the transparent conductive layer **4'** being on the upper, observational side.

[0111] As shown in **FIG. 6**, the touch panel **20** having the above-described construction is placed on top of a display **22**. When the surface of the touch panel **20** is pressed by a pen **23** or the like following the instructions displayed on the display **22**, the transparent conductive layers **4** and **4'** serving as electrode layers, separated by the spacer **21**, are electrically connected at the pressed point, and a predetermined signal is generated.

[0112] The transparent conductive films for use as the electrode sheets **1**A and **1**B are not limited to those ones shown in **FIG. 6**; and transparent conductive films having various structures as shown in **FIGS. 1A, 1B** and **2** can also be used. Further, it is preferable to use a thicker plate-shaped material as the transparent plastic film **2'** in the electrode sheet **1**B arranged on the back side so that the electrode sheet **1**B can withstand the pressure applied by a pen or the like.

[0113] (Electroluminescent Display Panel)

[0114] **FIG. 7** is a view showing an example of the application of the transparent conductive film **1** according to this embodiment, to an electroluminescent display panel **30**.