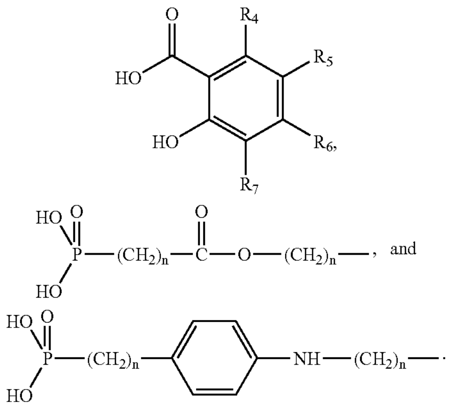
-continued



R_2 is selected from C_{1-10} alkyl, N-oxide, dimethylamino, acetonitrile, benzyl, phenyl, benzyl mono- or di-substituted by nitro; phenyl mono- or di-substituted by nitro. R_3 is C_{1-10} alkyl and R_4, R_5, R_6, and R_7 are each independently selected from hydrogen, C_{1-10} alkyl, C_1N_0 alkylene, aryl or substituted aryl, halogen, nitro, and an alcohol group. X is a charge balancing ion, and n=1-10.

[0028] Compounds of the formulae I-III are well known and may be prepared as described in Solar Energy Materials and Solar Cells, 57, (1999), 107-125 which is hereby incorporated by reference in its entirety. In a preferred embodiment, the adsorbed electrochromophore is bis-(2-phosphonoethyl)-4,4'-bipyridinium dichloride.

[0029] The base substrate **210** and the second substrate **250** are then assembled with an electrolyte **280** placed between the ion-permeable reflective layer **240** and the nano-structured film **270** having an adsorbed redox chromophore **275**. A potential applied across the cathode electrode **290** and the anode electrode **295** reduces the adsorbed redox chromophore **275**, thereby producing a color change. Reversing the polarity of the potential reverses the color change. When the redox chromophore **275** is generally black or very deep purple in a reduced state, a user perceives a generally black or very deep purple color. When the redox chromophore **275** is in an oxidized state and generally clear, a user will perceive light reflected off of the ion-permeable reflective layer **240**, which is generally white. In this manner, a black and white display is realized by a user.

[0030] Electrochromic display devices such as the one described above are described in greater detail in U.S. Pat. No. 6,301,038 and U.S. Pat. No. 6,870,657, both to Fitzmaurice et al., which are herein incorporated by reference.

[0031] As mentioned above, the adaptable skin **130** may be a pixilated display driven by and active or passive matrix. In another preferred embodiment, the adaptable skin **130** is an active matrix electrochromic display. Referring to FIG. **3**, an active matrix electrochromic adaptable skin **300** comprises a layer of active components **305** selectively deposited on a backplane substrate **310**. The backplane substrate is preferably flexible, however, it may be molded to fit the contour of a selected portable electronic device. It should be noted that the electrochromic display **300** contains 4 pixels D, E, F, and G, purely for illustrative purposes. Preferably, the active components **305** are n-channel metal-oxide-semiconductor field-effect (NMOS) TFTs. Alternatively, the active components may be p-channel metal-oxide-semiconductor field effect (PMOS) TFTs, complementary-symmetry metal-oxide-semiconductor field effect (CMOS) TFTs, thin film diodes (TFDs), micro-electromechanical structures (MEMS), or any other type of active device capable of being matrix addressed for switching an electrochromic pixel.

[0032] An insulating layer **315** is deposited on the active components **305**. The insulating layer **315** is substantially impermeable to the electrolyte **320**, thereby protecting the active components **305** from the possible corrosive effects of the electrolyte **320**. Preferably, the insulating layer **315** is a spin-coated polymer, such as polyimide. The insulating layer **315** is preferably reflective. The reflective property of the insulating layer **315** may be inherent in the material that comprises the layer, or reflective particles may be interspersed in the insulating layer **315**.

[0033] An operable connection **325**, known in the art as a via, is provided in the insulating layer for electrically connecting the drain of the active component **305** to a conductor **330**. Preferably, the operable connection **325** is created via photolithographic techniques, which are well known to those skilled in the art. Each operable connection **325**, or via, extends generally upwardly through the insulating layer **315** and is in electrical contact with a respective conductor **330**, which preferably covers the bottom and the sides of a plurality of wells **335** formed or etched into the insulating layer **315**. The operable connection **325** (i.e. via) and conductor **330** are preferably both transparent, and are preferably FTO or ITO.

[0034] The wells **335** are preferably etched in the insulating layer **315** using photolithographic techniques. Alternatively, the wells **335** are formed by mechanically embossing a deposited planar film or by application of a film containing a preformed waffle-type structure defining the wells **335**.

[0035] Partitions **340** maintain electrical isolation of each well **335**, and also allow the wells **335** to act as receptacles for ink-jet deposited materials. Partitions **340** may further act as a spacer between the cathode **345** and anode **350** of the adaptable skin **300**, and serve to reduce ionic crosstalk between pixels through the electrolyte **320**. The partitions **340** further serve the purpose of a visual boundary between each well **335**, and may be sized as desired to achieve optimal appearance of each well **335**. It is noted that although the partitions are shown as greatly extended generally above the wells **335**, they may alternatively be generally flush with the top of the wells **335**.

[0036] A semiconducting layer **360** having an adsorbed electrochromophore is deposited on the conductor **330**. Preferably, the semiconducting layer **360** is a nano-structured metallic oxide semiconducting film, as described hereinbefore.

[0037] A frontplane substrate **365**, which is substantially transparent, supports a substantially transparent conductor **370**. The substrate **365** may be any suitable transparent material, and again may flexible or contoured. FTO, ITO, or any other suitable transparent conductor may be used for the transparent conductor **370**.

[0038] A semiconducting layer **375** is deposited on the transparent conductor **370**. Preferably, the semiconducting