[0025] The display media can contain an electrically imageable material which can be addressed with an electric field and then retain its image after the electric field is removed, a property typically referred to as "bistable". Particularly suitable electrically imageable materials that exhibit "bistability" are electrochemical materials, electrophoretic materials such as Gyricon particles, electrochromic materials, magnetic materials, or chiral nematic liquid crystals. Especially preferred are chiral nematic liquid crystals, which can be polymer dispersed.

[0026] The display media can be configured as a single color, such as black, white or clear, and can be fluorescent, iridescent, bioluminescent, incandescent, ultraviolet, infrared, or can include a wavelength specific radiation absorbing or emitting material. There can be multiple layers of imaging material. Different layers or regions of the imaging material may have different properties or colors. Moreover, the characteristics of the various layers may be different from each other. For example, one layer can be used to view or display information in the visible light range, while a second layer responds to or emits ultraviolet light. The nonvisible layers may alternatively be constructed of non-electrically modulated materials that have radiation absorbing or emitting characteristics. The imaging material preferably has the characteristic that it does not require power to maintain display of indicia.

[0027] Many imaging materials, for example, cholesteric liquid crystals, are pressure sensitive. If the display media is flexed, thereby applying pressure to the imaging material in the display, the display can change state, thereby obscuring the data written on the display, or the imaging materials can be destroyed, as in the case of electrophoretic display materials. Therefore, the display media needs to be such that it is not permanently modified by pressure.

[0028] U.S. Pat. No. 6,853,412 discloses a pressure insensitive display media containing a polymer dispersed liquid crystal layer. The polymer dispersed cholesteric layer includes a polymeric dispersed cholesteric liquid crystal (PDLC) material, such as the gelatin dispersed liquid crystal material. Liquid crystal materials disclosed in U.S. Pat. No. 5,695,682 can also be used if the ratio of polymer to liquid crystal is chosen to render the composition insensitive to pressure. Application of electrical fields of various intensity and duration can drive a chiral nematic material (cholesteric) into a reflective state, to a transmissive state, or an intermediate state. These materials have the advantage of maintaining a given state indefinitely after the field is removed. exemplary cholesteric liquid crystal materials can be MERCK BL112, BL118, or BL126, available from E.M. Industries of Hawthorne, N.Y. One method of making such emulsions using limited coalescence is disclosed in EP 1 115 026A.

[0029] As noted above, a chiral nematic liquid crystal composition may be dispersed in a continuous matrix. Such materials are referred to as "polymer dispersed liquid crystal" materials or "PDLC" materials. Such materials can be made by a variety of methods. For example, Doane et al. (*Applied Physics Letters,* 48, 269 (1986)) disclose a PDLC comprising approximately 0.4 μm droplets of nematic liquid crystal 5CB in a polymer binder. A phase separation method is used for preparing the PDLC. A solution containing monomer and liquid crystal is filled in a display cell and the material is then polymerized. Upon polymerization, the liquid crystal becomes immiscible and nucleates to form droplets. West et al. (Applied Physics Letters 63, 1471 (1993)) disclose a PDLC comprising a chiral nematic mixture in a polymer binder. Once again a phase separation method is used for preparing the PDLC. The liquid crystal material and polymer (a hydroxy functionalized polymethylmethacrylate) along with a crosslinker for the polymer are dissolved in a common organic solvent toluene and coated on an indium tin oxide (ITO) substrate. A dispersion of the liquid crystal material in the polymer binder is formed upon evaporation of toluene at high temperature. The phase separation methods of Doane et al. and West et al. require the use of organic solvents that may be objectionable in certain manufacturing environments. These methods can be applied to other imaging materials, such as electrophoretic materials, to form polymer dispersed imaging materials.

[0030] Each discrete polymer-dispersed portion of imaging material is referred to as a "domain." The contrast of the display is degraded if there is more than a substantial monolayer of N*LC domains. The term "substantial monolayer" is defined by the Applicants to mean that, in a direction perpendicular to the plane of the display, there is no more than a single layer of domains between the electrodes at most points of the display (or the imaging layer), preferably at 75 percent or more of the points (or area) of the display, most preferably at 90 percent or more of the points (or area) of the display. In other words, at most, only a minor portion (preferably less than 10 percent) of the points (or area) of the imaging layer in the display has more than a single domain (two or more domains) between the electrodes in a direction perpendicular to the plane of the display, compared to the amount of points (or area) of the display in the imaging layer at which there is only a single domain between the electrodes.

[0031] The amount of material needed for a monolayer can be accurately determined by calculation based on individual domain size, assuming a fully closed packed arrangement of domains. (In practice, there may be imperfections in which gaps occur and some unevenness due to overlapping droplets or domains.) On this basis, the calculated amount is preferably less than about 150 percent of the amount needed for monolayer domain coverage, preferably not more than about 125 percent of the amount needed for a monolayer domain coverage, more preferably not more than 110 percent of the amount needed for a monolayer of domains. Furthermore, improved viewing angle and broadband features may be obtained by appropriate choice of differently doped domains based on the geometry of the coated droplet and the Bragg reflection condition.

[0032] One example of display media has a single layer of imaging material along a line perpendicular to the face of the display, preferably a single layer coated on a flexible substrate. Such a structure, as compared to vertically stacked imaging layers each between opposing substrates, is especially advantageous for monochrome displays. Additionally, structures having stacked imaging layers can be used to provide additional advantages in some cases, such as colored displays.

[0033] A problem with typical touch sensitive display device manufacture is that the display and touch sensor are fabricated separately, and combined upon final assembly.