doped domains based on the geometry of the coated droplet and the Bragg reflection condition.

[0042] One example of a display media sheet has simply a single imaging layer of polymer dispersed liquid crystal 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, is especially advantageous for monochrome displays. Structures having stacked imaging layers can be used to provide additional advantages in some cases, such as color.

[0043] Preferably, the domains are flattened spheres and have on average a thickness substantially less than their length, preferably at least 50% less. More preferably, the domains on average have a thickness (depth) to length ratio of 1:2 to 1:6. The flattening of the domains can be achieved by proper formulation and sufficiently rapid drying of the coating. The domains preferably have an average diameter of 2 to 30 microns. The imaging layer preferably has a thickness of 10 to 150 microns when first coated and 2 to 20 microns when dried.

[0044] The flattened domains can be defined as having a major axis and a minor axis. In a preferred embodiment of a display or display sheet, the major axis is larger in size than the imaging material layer thickness for a majority of the domains. Such a dimensional relationship is shown in U.S. Pat. No. 6,061,107. The domains are encapsulated with sufficient polymer so the domains can maintain an optical state when pressure or bending forces are applied to the imaging layer in an area of the display.

[0045] The flexible substrate can be any flexible self-supporting material that supports the conductor. Typical substrates can include plastics, glass, or quartz. “Plastic” means a polymer, usually made from polymeric synthetic resins, which may be combined with other ingredients, such as curatives, fillers, reinforcing agents, colorants, and plasticizers. Plastic includes thermoplastic materials and thermosetting materials.

[0046] The flexible material must have sufficient thickness and mechanical integrity so as to be self-supporting, yet should not be so thick as to be rigid. Typically, the flexible substrate is the thickest layer of the display. Consequently, the substrate determines to a large extent the mechanical and thermal stability of the fully structured display.

[0047] The flexible substrate can be polyethylene terephthalate (PET), polyethylene naphthalate (PEN), polyethersulfone (PES), polycarbonate (PC), polysulfone, a phenolic resin, an epoxy resin, polyester, polyimide, polyetherester, polyetheramide, cellulose acetate, aliphatic polyurethanes, polyacrylonitrile, polytetrafluoroethylenes, polyvinylidene fluorides, poly(methyl (x-methacrylates), an aliphatic or cyclic polyolefin, polyarylate (PAR), polyetherimide (PEI), polyethersulphone (PES), polyimide (PI), Teflon poly(perfluoro-alkoxy) fluoropolymer (PFA), poly(ether ether ketone) (PEEK), poly(ether ketone) (PEK), poly(ethylene tetrafluoroethylene)fluoropolymer (PETFE), poly(methyl methacrylate), various acrylate/methacrylate copolymers (PMMA), or a combination thereof. Aliphatic polyolefins may include high density polyethylene (HDPE), low density polyethylene (LDPE), and polypropylene, including oriented polypropylene (OPP). Cyclic polyolefins may include poly(bis(cyclopentadiene)).

[0048] A preferred flexible plastic substrate is a cyclic polyolefin or a polyester. Various cyclic polyolefins are suitable for the flexible plastic substrate. Examples include Arton™ made by Japan Synthetic Rubber Co., Tokyo, Japan; Zeanor T™ made by Zeon Chemicals L.P., Tokyo Japan; and Topas™ made by Celanese A. G., Kronberg Germany. Arton™ is a poly(bis(cyclopentadiene)) condensate that is a film of a polymer. Alternatively, the flexible plastic substrate can be a polyester. A preferred polyester is an aromatic polyester such as AryLite™ (Ferrania). Although various examples of plastic substrates are set forth above, it should be appreciated that the substrate can also be formed from other materials such as glass and quartz.

[0049] Although the discussion above is centered around using a polymer dispersed liquid crystal layer on a flexible polymer support, it will be understood by those practiced in the art that the display media can be any flexible, pressure insensitive, electronically updateable media. Other suitable materials can include, for example, electrochemical materials, electrophoretic materials, electrowetting materials, magnetic materials, electrochromic materials, or other liquid crystal materials.

[0050] The display as described herein can include a pre-written image in the display material, such as text, numbers, or symbols, that is changeable or unchangeable. The display can be permanently pre-written with applied text, numbers, or symbols, such as by ink jet, gravure, or thermal printing on the substrate, one or more conductive layer, or the imaging material layer of the display, or by application of a permanent or removable label.

[0051] The touch-input device can combine the display media and a touch sensor to form a touch sensor with visually updateable properties, or a display with touch input capability. The device can be assembled such that the media is placed between the user and the touch sensor. The media and the touchscreen can be separate, temporarily attached, permanently attached, or integrated into a single unit. The touchscreen and media can be transparent, translucent, opaque, or a combination thereof. The touchscreen and media can be the same size or shape, or different sizes or shapes. The media and touchscreen can each be completely or partially flexible. The media and touchscreen can each independently be permanently or temporarily attached to drive electronics. The drive electronics for the media and touchscreen can be separate or integrated.

[0052] The device can be understood with reference to certain embodiments including a cholesteric liquid crystal display element, as depicted in the Figures and described below.

[0053] FIG. **1** shows a side view of a traditional touch-screen-display device as known in the art. In this embodiment, the device consists of a resistive touchscreen **30** applied to the viewer **1** side of a rigid display plane **10**. The display plane consists of a first glass substrate **12**, an active display layer **21**, and a second glass substrate **12**. The glass substrates are held at a specific distance from one another in any of a variety of ways, including, but not limited to, spacer beads, embedded fibers, polymer layers, or microfeatures. The resultant display is typically very rigid, but sensitive to pressure, as many of the spacing methods compress under a load. Reduction of the gap between substrates can lead to appearance or electrical behavior changes in the display. In