

Claims:

1. A device comprising a volume comprising ferroelectric nematic liquid crystal-forming fluid and means for containing said fluid, said fluid comprising molecules having one or more electric dipoles, said molecules having spontaneously formed a ferroelectric polarization density, said spontaneous polarization density comprising a nonzero local unidirectional average orientation of said dipoles, and said polarization density comprising a magnitude and a vectorial direction in said volume.
2. The device of claim 1 for electrical control of an electromagnetic field, wherein said device includes one or more electrodes for application of an electric field to said volume, and the electromagnetic field propagates in said volume, said electric field causing said polarization density to change in magnitude, thereby producing a change in the electromagnetic field.
3. The device of claim 1 for electrical control of an electromagnetic field, wherein said device includes one or more electrodes for application of an electric field to said volume, and an electromagnetic field to be controlled propagates in said volume, said electric field causing said polarization density to change the vectorial direction, thereby producing a change in the electromagnetic field.
4. The device of claim 1 for producing electrically-driven motion, wherein said device includes one or more electrodes for application of an electric field to said volume, said electric field causing said polarization density to change in the vectorial direction and/or the magnitude, thereby producing a physical motion of or change of shape of said volume.

5. The device of claim 1 for performing mechanical sensing, wherein said device includes one or more electrodes for measuring the electric potential or current flow within said volume, said electric potential and/or current flow generated by change in said polarization density, said change due to a variation in stress within said volume or change of shape of at least a portion of said volume.
6. The device of claim 1 for thermally generating a charge density, wherein said device includes one or more electrodes for measuring an electric potential or obtaining a current flow within said volume, said electric potential and/or current flow generated by a change in said polarization density, said change of said polarization density produced by a change in temperature of said volume.
7. The device of any of claims 1-6, wherein said volume is contained between parallel surfaces.
8. The device of claim 7, wherein a/said electric field is applied parallel to the surfaces.
9. The device of claim 7, wherein the polarization density is parallel to said surfaces.
10. The device of any of claims 7 or 8 wherein said electromagnetic field has a polarization parallel to the surfaces.
11. The device of claim 2 or claim 3 wherein said electric field, said polarization density, and a polarization of said electromagnetic field are along the same line.

12. The device of any of claims 2, 3, or 7 wherein the electromagnetic field comprises one or more of microwave, infrared, visible, ultraviolet, and x-ray light, propagating in or reflecting from said device.
13. The device of claim 1 for performing molecular dipole scavenging, wherein said polarization density produces local molecular scale cavities, said cavities binding molecules having dipoles in said volume.
14. The device of any of claims 1-13 where said ferroelectric nematic liquid crystal-forming fluid comprises dimeric, oligomeric, or polymeric material.
15. The device of any of claims 1-13 where said ferroelectric nematic liquid crystal-forming fluid comprises elastomeric material.
16. The device of any of claims 1-13 where said ferroelectric nematic liquid crystal-forming fluid comprises a glass.
17. The device of any of claims 1-16, wherein the molecules comprise features suitable for the stabilization of a ferroelectric nematic phase comprising one or more of (1) a rod shape having a molecular long axis suitable for nematic liquid crystal ordering; (2) a substantial molecular net dipole parallel to the molecular long axis, said dipole stabilizing head-to-tail chaining of said rod-shaped molecules; (3) molecular sub-components along the molecular length giving localized charges of alternating sign distributed along said molecular long axis; (4) minimal flexible tails to enable dipolar charges to interact, but provide enough flexibility to suppress crystallization; and (5) lateral groups to control the relative positions along the director of side-by-side molecules, to promote their polar order.
18. A method of using any of the devices of claims 1-17.

19 A method for discovering molecular structures with features suitable for stabilization of the ferroelectric nematic phase, said method comprising atomistic molecular dynamic computer simulation, said simulation achieving thermal equilibration of at least two samples of a number of test molecules, said test molecules having a molecular dipolar structure, one of said samples comprising a polar collection of test molecules initiated with maximum polar order of said dipoles, and another one of said samples comprising a nonpolar collection of test molecules initiated with zero polar order of said dipoles, said method comprising the determination and comparison of the mode of forming of polar intermolecular correlations in the polar and nonpolar systems.