

Annexure I

Glossary

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Alignment layer: A layer and/or surface treatment applied to the boundary of a liquid crystal cell to induce a particular director orientation.

Amorphous: Irregular; having no discernible order or shape. In the context of solids, the molecules are randomly arranged.

Amphiphilic: A molecule with a hydrophilic head and a hydrophobic tail. That is, a molecule that has one end which attracts water and one end which repels water.

Anisotropic: Anisotropic substances are those, where the physical properties (like, refractive index, mechanical strength, conductivity etc.) are different in different direction.

Biaxial: Possesses two directions along which monochromatic light vibrating in any plane will travel with the same velocity. The optic axis lies just between these directions.

Bilayer: A double layer of amphiphilic molecules, arranged such that either the nonpolar ends are on the inside screened by the polar ends or the polar ends are on the inside screened by the nonpolar ends, depending on whether the solvent is polar or nonpolar.

Birefringence: It is the property of uniaxial anisotropic materials in which light propagates at different velocities, depending on its direction of polarization relative to the optic axis. It is also known as *double refraction*.

Chiral molecule: A molecule that is not identical to its mirror image. This gives a chiral substance its characteristic twisted shape, due to the fact that its molecules do not line up when combined.

Cholesteric liquid crystals: Also known as *Chiral Nematic*. Similar to the nematic phase, however, in the cholesteric phase, molecules in the different layers orient at a slight angle relative to each other (rather than parallel as in the nematic).

Columnar phase: A liquid crystal phase characterized by disc-shaped molecules that tend to align themselves in vertical columns.

Dendrimers: Highly branched molecules that have several layers of branching. These molecules exhibit a characteristic spherical shape.

Director: The molecular direction of preferred orientation in liquid crystalline mesophases.

Discotic liquid crystal: The component disc-shaped molecules self-assemble in a way that resembles stacks of coins. The discs are stacked on top of each other to form columns, which in turn are packed on a two-dimensional, usually hexagonal, lattice.

Ferroelectric material: One that produces domains of spontaneous polarization whose polar axis can be reversed in an electric field directed opposite to the total dipole moment of the lattice.

Homeotropic texture: A mesogen configuration in which the molecules are aligned normal to the boundary surfaces, as at the faces of a liquid crystal cell, as illustrated. Consequently the director will be normal to the surface. This orientation is generally obtained by the application of an electric field normal to the surface but can be achieved through surface treatment.

Homogeneous: A uniform structure or composition throughout. Having or possessing the same properties.

Homogeneous (planar) texture: A mesogen configuration in which the molecules are aligned parallel to the boundary surfaces, as at the faces of a liquid crystal cell.

Liquid crystal: A thermodynamic stable phase characterized by anisotropy of properties without the existence of a three-dimensional crystal lattice, generally lying in the temperature range between the solid and isotropic liquid phase, hence the term mesophase.

Lyotropic: Materials in which liquid crystalline properties appear induced by the presence of a solvent, with mesophases depending on solvent concentration, as well as temperature.

Mesogen: Rigid rodlike or disclike molecules which are components of liquid crystalline materials.

Mesogenic cores: The mesogenic core is the primitive structural unit of a polymer having the requisite anisotropic shape and attractive interactions to establish long range

intermolecular order in its liquid phase. That is, it is what gives a polymer liquid crystal its liquid crystal properties.

Mesomorphic substance: Another term for a liquid crystal material.

Mesophase: Equilibrium liquid crystalline phases formed with order less than three dimensional (like crystals) and mobility less than that of an isotropic liquid. Parallel orientation of the longitudinal molecular axes is common to all mesophases (long-range orientational order)

Monotropic: A type of material which exhibits the liquid crystalline state only when the temperature changes in one direction. This is generally a result of the liquid crystal phase being below the melting temperature of the solid, where the liquid crystal phase is only observed if the liquid is supercooled below the melting point.

Nematic mesophase: Liquid crystals are characterized by long-range orientational order and the random disposition of the centers of gravity in individual molecules. Nematics may be characterized as the simplest spontaneously anisotropic liquids.

Order parameter: Order parameter, S describes the orientational order of liquid crystalline material, allowing for the individual orientational deviation of the molecules from the director, which represents the average over the collection. Typically, S ranges from 0.3 to 0.9, depending on the temperature, with a value of unity for perfect order.

Orientational order: Measure of the tendency of the molecules to align along the director on a long-range basis.

Polarizer (linear): A device, which in the transmission of electro-magnetic radiation, confines the vibration of the electric and magnetic field vectors to one plane.

Positional order: The extent to which the position of an average molecule or group of molecules shows translational symmetry.

Schlieren texture: The texture that appears in the optical microscopy of nematic and related smectic C phases under crossed polarizers when the planarity of the phase is interrupted by defects. The schlieren, dark streaks or brushes, form in the liquid crystal, connecting the defect points. The dark streaks or brushes that are characteristic of this texture may also appear along disclinations in a liquid crystal.

Self-assembly: The aggregation of molecular moieties into more ordered structures that are thermodynamically stable and involve noncovalent bonds.

Smectic mesophase: The molecules organize themselves into layers. The smectic phases form a one dimensional periodic lattice in which the individual layers are two dimensional liquids. Now 12 different smectic phases have been identified.

Spacer: Flexible section of polymer chain between two mesogens or the mesogen and the backbone of a polymer.

Thermotropic: Liquid crystal molecules which exhibit temperature dependent liquid crystalline behavior.

Translational order: A condition when molecules have some arrangement in space.

Twisted Nematic (TN): A type of liquid crystal in which the alignment surface, and therefore the liquid crystal molecules, is oriented 90 degrees from each surface of glass.

Uniaxial materials: Possess only one direction along which monochromatic light vibrating in any plane will travel with the same velocity. This direction is known as the optic axis.