

## WHAT ARE LIQUID CRYSTALS?

Some organic solids having long rod-like molecules do not melt to give the liquid substance directly. They, instead, pass through an intermediate state called the **liquid crystal state**, often referred to as the **liquid crystal**. Thus the liquid crystal state is intermediate between the liquid state and the solid state.

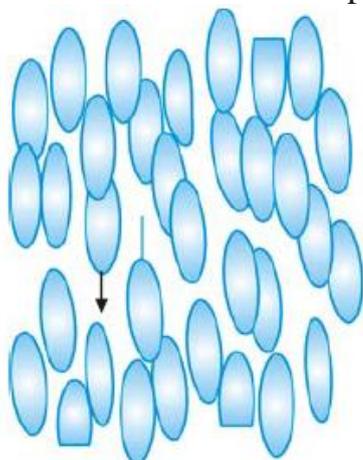


**The liquid crystals have a structure between that of a liquid and that of a crystalline solid.** In a liquid the molecules have a random arrangement and they are able to move past each other. In a solid crystal the molecules have an ordered arrangement and are in fixed positions. In liquid crystals, however, molecules are arranged parallel to each other and can flow like a liquid. **Thus the liquid crystals have the fluidity of liquid and optical properties of solid crystals.**

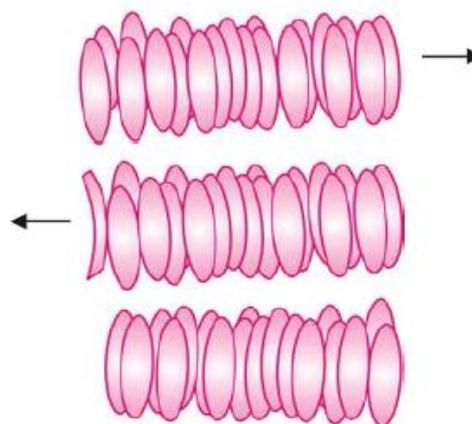
### Types of Liquid Crystals

According to their molecular arrangement, the liquid crystals are classified into three types.

- 1. Nematic liquid crystals.** They have molecules parallel to each other like soda straws but they are free to slide or roll individually.
- 2. Smectic liquid crystals.** The molecules in this type of crystal are also parallel but these are arranged in layers. The layers can slide past each other.
- 3. Cholesteric liquid crystals.** As in nematic crystals, in this type of crystal the molecules are parallel but arranged in layers. The molecules in successive layers are slightly rotated with respect to the layers above and below so as to form a spiral structure.



Nematic liquid crystal



Smectic liquid crystal

## **Applications and prospects of liquid crystals**

- (a) Display applications:** By virtue of their fluid nature, LCs can be easily processed into thin films, yet they retain the optical properties of crystalline materials such as the ability to rotate plane polarized light. In addition, the orientation of the molecules in liquid crystal films can be modulated on a relatively short time scale using a low electric field.
- (b) Temperature sensors:** Cholesteric nematic liquid crystals reflect light with a wavelength proportional to the magnitude of pitch. Because the pitch is dependent upon temperature, the colour reflected also is dependent upon temperature. Thus, cholesteric LCs make it possible to accurately gauge temperature just by looking at the colour.