

The *Old* Phase Separation Method and Its *New* Limits

Satyendra Kumar
Department of Physics
Kent State University
Kent, OH, USA

The phase separation method has been a powerful tool since the early days of liquid crystal field. Initially, it was used to positively identify the nature of liquid crystalline phases. In the recent past, it has been used to study the phenomena of confinement and its effect on the critical behavior at several phase transitions. Phase separation is the process that leads to several display technologies such as *Polymer Dispersed* liquid crystals and *Polymer Stabilized* cholesteric and ferroelectric devices.

Several limits of the general phenomena of phase separation have been discovered in recent years. A very simple and powerful process known as *phase separated composite structures* method permits one to construct conventional devices; such as, TN, STN, and FLC devices; with great ease and with flexible substrates. It has also been employed to fabricate one- and two-dimensional optical gratings and *fly's eye lenses* (micro-lens array) with electrically controllable focal length.

One of the two limits discovered in the past 2 years allows construction of devices with *polymer columns* perpendicular to the substrates. These structures have been used to fabricate large area homeotropic nematic devices having very high-contrast. In yet another limit, referred to as *polymer enhancement*, the polymer mass gathers near the spacers and upon polymerization binds the spacers to the two substrates providing high mechanical stability against pressure, decompression, shock, and bending. This limit is highly suitable for use in plastic displays.

After a general overview of the phenomena of phase separation, specific examples of device construction will be presented.