DSC study of bent-core and rod-shaped liquid crystal mixtures

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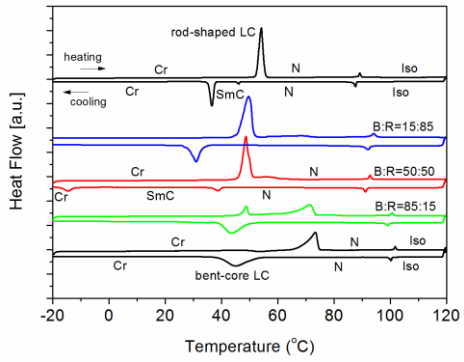
Bent-core mesogens represent a novel class of thermotropic liquid crystals which have become targets of extensive studies in the last decade. Study of the liquid-crystalline properties of bent-core molecules, such as the observation of ferroelectricity and spontaneous chiral symmetry breaking in smectic phases composed of achiral molecules has broad implications for the general field of soft condensed matter [1]. Creating mixtures of bent-core and rod-shaped molecules can form liquid crystalline phase at the room temperature and be useful in possible practical applications.

Differential scanning calorimetry (DSC) is a useful tool that complements optical methods in the study of liquid crystal phase transformations. In this work, phase transitions of binary mixtures of the bent-core 4,6-dichloro-1,3-phenylene-bis [4´-(9-decen-1-yloxy)-1,1´-biphenyl] 4-carboxylate (10DClPBBC) and the rod-shaped 4-n-octyloxyphenyl 4-n-hexyloxybenzoate (6OO8) liquid crystals were studied using the DSC method and compared with results obtained by Nair et al. [1] using polarizing microscope. We focused on the study of the crystallization kinetics of the binary mixtures.



DSC traces obtained for bent-core (B) and rod-shaped (R) LCs and for their mixtures with different weight ratios (wt %) B:R during the first heating and cooling cycle at a rate of 10 °C/min.

The presence of crystal to nematic and nematic to isotropic transitions was confirmed (as the Fig. shows) for all samples during heating. In cooling a slight displacement of the isotropic-nematic and greater changes in crystallization transition temperatures were observed. For the binary mixture with the wt ratio of 50:50 nematic to smectic transition appeared below 40 °C and the crystallization temperature was shifted to sub-ambient temperature. We also showed that the crystallization temperature changes significantly with varying the cooling rate (data not shown). Our results obtained from the DSC study are in good agreement with the ones obtained from polarizing microscopy measurements by Nair et al. [1] and they could be helpful in improving the phase diagram of the binary mixture 10DClPBBC – 6OO8 in the intermediate concentration range.

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References:

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