

Synthesis and electronic/optical properties of dimesogenic asymmetric bent-core molecules

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Bent-core liquid crystal molecules with C_{2V} molecular symmetry can reveal a spontaneous polarization without a chiral carbon¹. These molecules can show polar smectic phases, so-called B-phases. Therefore they may represent the polar switching phenomenon. In the meantime, the dimesogenic molecules with an even spacer have generally linear conformation. On the other hand, the ones with an odd spacer have non-linear conformation². The dimesogenic molecules with such two differential conformations may show quite different mesomorphic behavior from monomesogenic molecules.

In this study, we have synthesized six dimesogenic bent-core molecules which contain 3,4,5- and 2,4,6-trifluoro substituents in the terminal benzene ring of the two mesogens (Ar = 3,4,5- or 2,4,6-trifluorophenyl). Also, the molecules have 5, 6 and 12 carbons in the flexible alkyl spacer ($n = 5, 6$ and 12). The structures of compounds were identified by FT-IR and ¹H-NMR spectroscopy. The purity of compounds was confirmed by thin layer chromatography and elementary analysis. Their mesomorphic properties and phase behavior were investigated by differential scanning calorimetry (DSC), polarizing optical microscopy (POM), X-ray diffraction (XRD) and electro-optical (E/O) measurements.

Compound with Ar = 2,4,6-trifluorophenyl/ $n = 6$ and compounds with Ar = 3,4,5-trifluorophenyl/ $n = 5, 6$ and 12 showed an enantiotropic nematic mesophase. Compound with Ar = 2,4,6/ $n = 12$ showed a monotropic nematic mesophase. Compound with Ar = 2,4,6-trifluorophenyl/ $n = 3$ was non-liquid crystalline. As shown in Figure 1, compound with Ar = 3,4,5-trifluorophenyl/ $n = 12$ displayed the interesting drive phenomena that depend on the applied voltage and frequency.

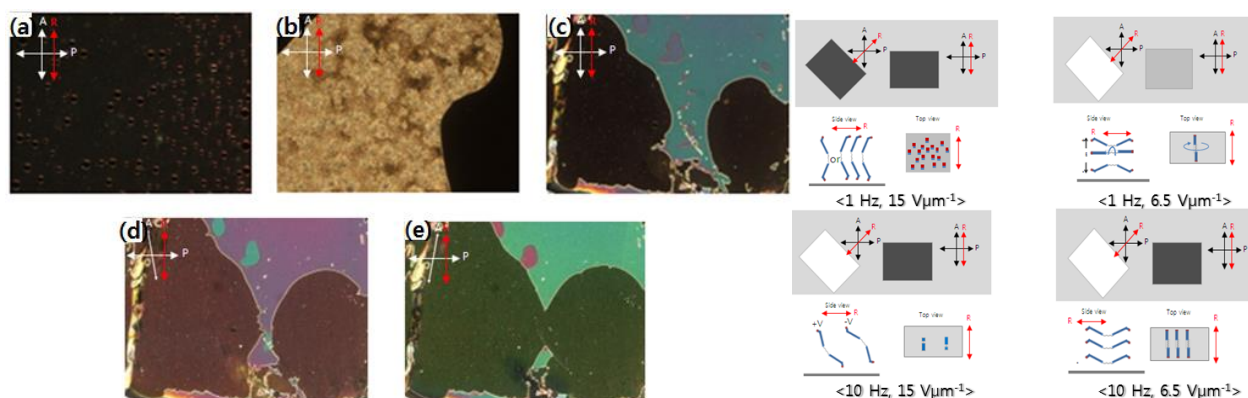


Fig. 1 Cross-polarizing micrographs in the nematic phase of compound with Ar = 3,4,5-trifluorophenyl/ $n = 12$ on applying a AC field at frequency of 1 Hz. The temperature of the cell was 200 °C. Rubbing direction was parallel to the polarized direction of the incident beam: (a) without applied field; (b) 6.5 $V\mu m^{-1}$ applied; (c) with the electric field off (0 $V\mu m^{-1}$); (d) analyzer's rotation angle of counterclockwise 10°; (e) clockwise 10°.

References

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