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Synthesis and mesophase characterization of methacrylate based three phenyl ring core side chain liquid crystalline copolymers

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Abstract

A new series of side chain liquid crystalline copolymers consisting of a mesogenic monomer and a nonmesogenic n-butyl methacrylate are prepared by free radical solution polymerization. The mesogenic monomer is synthesized by a multistep route and is built with side arm core consisting of three phenyl rings linked by an ester and a terminal alkoxy chain at one end and hexamethylene spacer between methacyrlate unit and the phenyl ring core. The copolymers are synthesizedwith different feed ratios of liquid crystallinemonomer and n-butyl methacrylate to realize composition dependent copolymers. The mesogenic monomers are characterized by FTIR, (sup)1H and (sup)13C NMR while for a representative mesogen solution two-dimensional (2D) NMR experiments are also carried out. The hot-stage optical polarized microscopy, differential scanning calorimetry and variable temperature powder X-ray diffraction investigations revealed the existence of enantiotropic nematic (N) and smectic C (SC) mesophases for the copolymers. The weight average and number average molecular weight of the copolymers are found to be in the range 1.6 × 10(sup)4 to 3.7 × 10(sup)4 g/mol from gel permeation chromatography. Thermal degradation profile of mesogenic copolymers investigated by thermogravimetric analysis revealed that the copolymers are stable till 335 °C in nitrogen atmosphere. The copolymer compositions were determined using 1H NMR analysis.