The behavior of diamagnetic macromolecules in a magnetic field

S A Vshivkov
Ural Federal University, Russia

The effect of a magnetic field on the phase transitions, structure, and rheological properties has been studied for the liquid crystalline cellulose derivative – solvent systems: hydroxyethyl cellulose – water, hydroxyethyl cellulose - DMAA, hydroxyethyl cellulose - DMF, hydroxypropyl cellulose - water, hydroxypropyl cellulose - DMF, hydroxypropyl cellulose – DMAA, hydroxypropyl cellulose – ethanol, ethyl cellulose – DMAA, cyanoethyl cellulose – DMAA, cyanoethyl cellulose – DMF, Na-carboxymethyl cellulose–water. Phase diagrams are constructed and the regions of existence of isotropic and anisotropic phases and the dimensions of macromolecules and supramacromolecular particles in a wide composition range are determined. Under application of magnetic field, the domain structure is formed in solutions and the temperature–concentration region of the liquid crystalline phase widens. The studied systems are found to possess memory: after the magnetic field is switched off, the orientation of macromolecules and the increased temperature of phase transitions are preserved for many hours. As the molecular mass of the polymer is increased, the ability of macromolecules to orient themselves in the magnetic field declines. The concentration dependence of supramolecular particle radius in the presence of the magnetic field is described by a curve with maxima. The threshold mechanism governing the effect of magnetic field on liquid crystalline transitions in polymer solutions has been discovered. The critical value of magnetic intensity that brings about a shift in boundary curves is consistent with the critical value of Hcr necessary for the cholesteric liquid crystal – nematic liquid crystal phase transition. Application of a magnetic field is shown to be accompanied by an increase in the viscosity of these systems by a factor of 1.3 – 4. The concentration dependence of viscosity in the presence of a magnetic field is described by curves with an extremum.

sergey.vshivkov@urfu.ru