PHASE EQUILIBRIA IN SOLUTIONS OF CELLULOSE DERIVATIVES AND THE RHEOLOGICAL PROPERTIES OF SOLUTIONS IN VARIOUS PHASE STATES

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Solutions hydroxypropyl cellulose (M_w=80 000) in water, dimethyl sulfoxide (DMSO), propylene glycol (PG), triethyl citrate (TEC) and polyethylene glycol M_w=1500 (PEG 1500) were investigated by microinterference method, polarization microscopy and viscosimetry. The phase-transition lines were constructed with the use of microinterference and polarization microscopy methods. In a certain temperature–concentration range, all solutions undergo a sequence of transitions typical for solutions of stiff-chain crystallizable polymers: isotropic and LC states separated by the two-phase corridor and, in some cases, the crystalline state. For HPC-water, HPC-TEC and HPC-PEG 1500 solutions the superposition of amorphous, LC, and crystalline equilibria is realized. Amorphous separation with LCST is observed for HPC-water, with UCST for HPC-TEC and HPC-PEG 1500.

Solutions occurring in various phase states were tested by rheological methods. These solutions demonstrate the typical rheological behavior of anisotropic solutions: the presence of yield stress and the extremum concentration dependence of viscosity with a maximum, when the LC phase appears, and a minimum, when it transforms into the 100% phase. In the case of single-phase solutions, viscosity increases with concentration, while for two-phase solutions, viscosity decreases with an increase in the fraction of the LC phase. The rheological data are found to be sensitive to phase transitions observed in solutions.