RHEOLOGICAL PROPERTIES OF CELLULOSE DERIVATIVE SOLUTIONS UNDER MAGNETIC FIELD

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Cellulose ethers and their solutions are partially crystalline and liquid crystal (LC) systems. They are widely used in the production of fibers, films, coatings, membranes, dyes, and so on. Melting temperature of LC polymers is close to or greater than the temperature of polymer destruction. Therefore, such polymers are processed through solutions. Despite the complexity of these processes, through solutions every year processed millions of tons of polymer materials.

The structure, phase diagram, and Rheological properties of hydroxypropyl cellulose (HPC) in ethylene glycol (EG) and ethyl cellulose (EC) and dimethylformamide (DMF) solutions were investigated with the aid of the cloud-point method, polarization microscopy, and rheometer. The phase diagram is composed of two regions. The isotropic phase which appeared at low concentration, and Cholesteric liquid crystals (anisotropic phase) are formed at high concentrations. Investigation of the optical properties with the effect of the magnetic field and in its absence was studied with the aid of the turbidity-spectrum method. The rheological properties of solutions have been investigated in the presence of a magnetic field and in its absence. Application of a magnetic field leads to the formation of the domain structure in the solutions since the macromolecules are oriented in a magnetic field parallel to the long chains of field lines. This leads to increase in the number of contacts between the macromolecules, and, as a result, to the formation of supramolecular particles, especially near the LC phase transition.

The number of macromolecules that are capable of orientation in a magnetic field increased with increasing polymer concentration and magnetic field effect on the properties of the system increases (increasing the viscosity). However, at high concentrations, it increases the density of fluctuation entanglement network, which prevents the flow of the orientation process and weakens the influence of the magnetic field on the properties the solutions (the viscosity decreases). In the anisotropic region, the viscosity decreases due to both easier orientations of macromolecules and supramolecular particles during flow and smaller particle sizes. The concentration dependence of viscosity systems is described by curves with a maximum, concentration that matches or is close to the phase transition of the concentration of the LC phase transition.