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PLASTICIZATION OF CELLULOSE ACETATES AND NITRATES

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Cellulose takes the first place in abundance among all natural polymers. Various cellulose derivatives, in particular, cellulose acetates (CA) and cellulose nitrates (CN) are widely used as well. They act as raw materials in the production of smokeless powder, artificial fibres, insulating materials and films, varnishes and other products. However, the above-mentioned cellulose derivatives have high glass transition temperatures (T_g). For CA, T_g lies in the range of 370-490 K, and CN stays glassy up to a temperature of its thermal decomposition. Therefore, in order to provide CA and CN, the required set of physicochemical and mechanical properties modification by plasticization is used. However, there is a noticeable gap between the theoretical (thermodynamic) basis of the plasticization processes and practice in polymer systems production. In order to fill this gap, this review presents data on the thermodynamic characteristics (heat capacity, enthalpy, entropy, and Gibbs function) in the range from 4 to 580 K for CA and CN with various degree of OH–groups substitution of cellulose with acetyl and nitrogroups, as well as the major plasticizers for these polymers, their relaxation temperatures and phase transitions temperatures, the effect of plasticizers on CA and CN properties and the solubility of plasticizers in this polymers. Based on the obtained data, phase diagrams for CA and CN plasticizer systems were plotted and analyzed in a wide temperature range and in the entire concentration range of the components. These diagrams make it possible to determine the temperature and concentration limitations for the formation of homogeneous mixtures, i.e. true solutions of plasticizers in polymers and polymers in plasticizers, as well as two phases' gels, where one of the solutions dispersed in a matrix of another as microdroplets.

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