EFFECT OF IRRADIANTION ON RHEOLOGICAL FEATURES OF POLYVINYL ALCOHOL

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Change of viscosity of polyvinyl alcohol aqueous solution irradiated with γ-rays (Co^{60}) within the range of doses of $10\text{-}10^4$ Gy is studied. Solutions concentration varied from $0.1\%_{mass}$ to $10\%_{mass}$, the temperature of tests varied within the range from 20^oC to 80^oC, range of loads applied varies from 9810 dyn/cm^2 to 98100 dyn/cm^2.
Problems of polyvinyl alcohol solutions rheology are studied considering irradiation intensity. It is detected that after influence of γ-rays on PVA solutions, the viscosity of the last growth symbasically with the irradiaton dose in the whole range of concentration; viscosity of solutions not subjected to irradiation does not change practically with the growth of shear stress which indicates Newtonian character of their flow. Long-term stand of solution during five months leads to viscosity grows of irradiated solutions as well as of not subjected to γ-irradiation ones. Experimental data reveal a broad interval of irradiated solutions viscosity being dependent on temperature: at a low temperature viscosity of irradiated solutions is higher then this of non-irradiated ones, at higher temperatures it is lower; decrease of the viscosity in comparison with that of irradiated solutions takes place in area of temperatures about 40^oC. Differences in viscosity vs temperature dependencies of irradiated and non-irradiated solutions grow with increase of irradiation doses and solution concentrations.
Increase of values of irradiated solutions viscosity is caused by processes of radiation bridging of PVA macromolecules which dominate over radiation destruction over the investigated range of irradiation doses. Growth of viscosity in the process of solutions stand is a result of processes of gel-formation in PVA solutions which nature is connected directly with several processes occurring in the bulk of solution. One can explain the described above temperature-viscosity behavior of irradiated solutions as follows: at low temperatures the higher viscosity is caused by dominating processes of radiation bridging; at the temperature increase the signs of radiation destruction reveal themselves – lesser length of macromolecules provides lower viscosity. These solutions are not obeying the Newton rule. The phenomenological description of the process of PVA vitrification is given regarding Maxwell model on the base of experimental spectra of inner friction.