RHEOLOGY OF LIVING AND POLYMER CHAINS

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Viscoelastic solutions containing entangled polymer and micellar chains are of special interest because micellar chains enhance responsive properties of the system, whereas polymer chains make the system more stable, for instance, at heating. In particular, one could suggest that addition of polymer macromolecules can widen the range of temperatures corresponding to viscoelastic properties of these solutions, because polymer chains are not disrupted at heating like micellar chains.

The aim of my research is to study the effect of temperature on the viscoelastic properties of solutions of potassium oleate and of its mixtures with hydrophobically modified polyacrylamide (HM PAAm).

It was shown that the viscosity of semidilute solutions potassium oleate have a high values up to 400 Pas and elastic modulus up to 50 Pa at 20^0C. It was shown that heating of these solutions from 20 till 80^0C leads to the drop of viscosity by 4 orders of magnitude. At the same time the elastic modulus disappears above 45^0C. The values of the activation energy E_a are equal to 128±2 kJ/mol and E_a = 126±2 kJ/mol for 3wt.% and 0.7 wt.% potassium oleate solutions, respectively. Therefore, the values of E_a are independent on the surfactant concentration. High values of E_a indicate a pronounced drop of viscosity with increasing temperature. In the other case it was shown that in the whole studied range of surfactant concentrations the viscosity of surfactant/polymer solutions is always higher than for "pure" surfactant (without polymer) at 20^0C. The effect reaches two orders of magnitude. The behaviour of storage and loss moduli at heating is analogous to that for "pure" surfactant. But surfactant/polymer solution keeps elasticity in a wider temperature interval than "pure" surfactant solution, i.e. the network becomes more stable at heating. The activation energy of viscous flow decreases with increasing amount of added polymer. The dependences of viscosity and of elasticity moduli of surfactant/polymer solution on the amount of added polymer were obtained. It was shown that both the viscosity and the elasticity moduli become higher with increasing polymer concentration. This may be explained by larger amount of entanglements in the system. It should be noted that at polymer concentrations higher than c* the hydrophobic side groups of polymer form additional cross-links (micelle-like hydrophobic domains), which strengthen the viscoelastic properties of the system.

Thus, the addition of HM PAAm to viscoelastic solution of potassium oleate results in higher viscosity and elasticity moduli of the system and enhances the thermostability of solutions, thus widening the area of their practical application.