RHEO-OPTICS OF LIVING POLYMERS: SMALL-ANGLE LIGHT SCATTERING PATTERNS OF CETYLTRIMETHYLAMMONIUM TOSYLATE SOLUTIONS IN PRESENCE OF SODIUM BROMIDE

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In this work, we present a study based on Small-Angle Light Scattering (SALS) patterns of the simple shear-flow response of semi-diluted solutions of cetyltrimethylammonium tosylate (CTAT; 5.5 wt.% - 0.12 M), in the presence of sodium bromide (NaBr) at different concentrations [NaBr] = {0, 0.12, 0.19, 0.25, 0.3} M [1]. We provide evidence of a relationship between rheological and light scattering data that reveals a transition into a fast-breaking regime in the dynamics of wormlike micelles formed by CTAT/NaBr system. This transition is evident with the increasing NaBr concentration, which is marked by the following features: (i) a decrease in the relaxation time λ_0, accompanied by (ii) a dimmish of the viscosity magnitude at low shear rates, η_0. (iii) Formation of butterfly-like scattering patterns, caused by concentration fluctuations due to the imposed flow, correlated with (iv) the development of banded flow in the velocity gradient direction, and (v) signs of a transition to a distinct flow regime, recorded through the formation of a second peak in the structure factor. In addition, we report that the Cox-Merz rule is fulfilled at molar salt-to-surfactant ratios of R≥1.5 which, according to estimates of the BMP model, results in shorter structure-recovery time-scales than the characteristic-time of the flow. Finally, from a theoretical perspective, we provide predictions for the shear–stress and the first normal-stress growth coefficients in transient start-up simple shear flow using the BMP model for the samples with R=0 and R=1.5, where it is observed that the R=1.5 solution displays overshot responses at shear rates corresponding to the non-monotonic region of the steady-state flow curve. Our results are in-line with experimental findings in other investigations [2-6].

Keywords: Living polymers, Fast-breaking regime, Light scattering patterns

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