

ON THE EFFECTS OF SALT IONIC STRENGTH AND CONCENTRATION ON THE RHEOLOGICAL RESPONSE OF LIVING POLYMERS: WORMLIKE MICELLAR CTAT SOLUTIONS STUDIED WITH RHEO-OPTICAL SALS TECHNIQUES

Moisés Romero-Ureña¹, Luis Medina-Torres¹, Octavio Manero², J. Esteban López-Aguilar¹

¹Univeridad Nacional Autónoma de México, Departamento de Ingeniería Química, Facultad de Química, Mexico. ²

Univeridad Nacional Autónoma de México, Instituto de Investigaciones en Materiales, Mexico.

In the present work we provide experimental evidence on the influence of ionic strength and concentration of different salts, belonging to the Hofmeister series for CTA⁺ head-group, with mono (NaF), di ((COONa)₂) and tri (Na₃PO₄) valent characteristics [1], on the rheo-optical properties of 5 % wt. aqueous wormlike micellar solutions (WLMs) of cetyltrimethylammonium tosylate (CTAT) at, measured simultaneously under simple shear flow with a Small-Angle Light Scattering (SALS) technique. We reveal a relationship between the fast-breaking regime and development of SALS “butterfly-like” patterns for CTAT solutions and these salts. Firstly, we analyse the effects of three salts in a non-destructive test, Small-Amplitude Shear Oscillatory (SAOS), where the di and tri valent salts cause a relatively sharper decrease in the relaxation time, complex viscosity magnitude and contour length. Under simple shear flow, η follows a similar trend to $|\eta^*|$, where the increase in salts concentration and shift to the salting-out side promotes a smaller first-Newtonian-plateau level. The comparison between η and $|\eta^*|$ reveals that the Cox-Merz rule is satisfied at lower molar ratios [2,3], as there is a displacement towards salting-out salts. BMP model estimates of the structural relaxation time, λ_s , and the Maxwell relaxation time at high shear rates, λ_∞ [4], show a faster structural recovery with di and trivalent salts, in contrast to mono-valent salts. In addition, the SALS-pattern analysis reveals that an earlier transition to the fast breaking-regime generates an appearance of the scattering patterns at lower shear rates, suggesting that the salting-out salts promote an enhancement in concentration fluctuations. Finally, the structure factor plots display that salting-out salts cause the formation of a second shoulder in relatively smaller salt concentrations and shear rates than salting-in salts.

References

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Presenting author's email: boch@comunidad.unam.mx