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Electrorheological Properties of Suspensions Prepared from Poly(Li-tert-butyl methacrylate) Ionomer


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Abstract: The synthesis, characterisation and partial hydrolysis of poly(tert-butylmethacrylate), (PTBMA), and the electrorheological (ER) properties of its suspensions were investigated. The polymer was synthesised by radical polymerisation and partially hydrolysed by para-toluenesulphonic acid monohydrate (PTSA.H₂O), and then converted to a lithium salt (PTBMA-Li) by washing with a LiOH_(aq) solution. From particle size measurements, the average particle size of PTBMA-Li was determined to be 74 µ m. Colloidal suspensions of ionomer were prepared in various insulating oils [silicone oil (SO), mineral oil (MO), threeoctylthreemellitate (TOTM) and dioctylphatalete (DOP)] at a series of concentrations (c = 5-33 m/m, %). The sedimentation stabilities of these suspensions were determined at 20 °C and were observed to increase with decreasing suspension concentration. Maximum gravitational stability was observed as 32 days in SO at c = 5 m/m, %. Flow times of suspensions were measured under no applied electric field (E = 0 kV/mm), and under an external electric field (E ≠ 0 kV/mm), and ER activity was determined. The highest flow time was found to be 32 s in SO at c = 33 m/m, %. Further, the effects of solid particle concentration, shear rate (γ), electric field strength, (E) addition of polar promoters and high temperature on the ER activities of colloidal suspensions were investigated. Excess shear stresses (Δ τ) were determined to be 74 Pa under E = 1.0 kV/mm.

Key Words: Electrorheological fluids, poly(tert-butylmethacrylate), ionomer, colloidal dispersions

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