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An Investigation of Some Parameters on Electrorheological Properties of Polypyrrole Suspensions

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Abstract: In this study, polypyrrole (PPy) was synthesized by cationic addition polymerization. The polymer was characterized by FTIR spectroscopy, scanning electron microscopy (SEM), particle size, magnetic susceptibility, and four-probe conductivity measurements. From the magnetic susceptibility measurements, it was found that the polymer was a bipolaron conducting mechanism. From the particle size measurements, the average particle size of PPy was determined to be 3.2 μ m. Suspensions of this polymer were prepared in silicone oil, mineral oil, trioctyltrimellitate (TOTM), dioctylphthalate (DOP) and marlotherm-s in different concentrations (5-20%, m/m). The electrorheological (ER) properties of these suspensions were investigated under various d.c. electric field strengths (E = 0-1kV/mm), and shear rates ({\mathop {γ} \limits·} = 0.1-20 s^{-1}). The effects of temperature and promoter on ER activity were also studied, and the stabilities of suspensions against sedimentation were determined. The suspensions of PPy, prepared in TOTM insulating medium, showed the highest ER activity (1200 Pa) at 12.5% particle concentration. Excess shear stress (Δ τ) was found to increase with increasing concentration and reached 231 Pa. Further, sedimentation stabilities of suspensions were also observed to increase with decreasing particle concentration, and maximum colloidal stability was obtained in TOTM as 71 days. From the experiments, it was concluded that PPy suspensions exhibited a shear-thinning visco-elastic behavior and their ER activities were not temperature or promoter dependent and they were classified as dry-ER fluids.

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