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Abstract

Title of Document: **Rheological and Electrorheology of fumed silica nanoparticles in silicone oil: Effect of surface chemistry and nanoparticle loading.**

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Discipline of Chemical Engineering

Hydrophilic fumed silica (Aerosil 200) and hydrophobic fumed silica (Aerosil R972) nanoparticles are dispersed in the isotropic silicone oil at different nanoparticle loadings. Aerosil 200/silicone oil and Aerosil R972/silicone oil suspensions show an increase in viscosity and dynamic moduli with increase in loadings of nanoparticles. Gelation of Aerosil 200/silicone oil occurs at lower volume fraction of nanoparticles as compared to Aerosil R972/silicone oil due to the higher surface –OH functional groups present on Aerosil 200 surface. Both the suspensions above gelation show shear thinning behavior. The transient behavior of

the suspensions is also investigated. We found that only Aerosil 200/silicone oil suspensions exhibit thixotropic behaviour. The substantial amount of structure recovery is obtained in case of Aerosil 200 suspension on cessation of high oscillatory γ = 10%. In contrast, once the structure of Aerosil R972/silicone oil break-down, no significant structure recovery is seen. Furthermore, rotational measurements of liquid-like suspensions of Aerosil 200/silicone oil and Aerosil R972/silicone oil in presence of electric field E is investigated. Aerosil 200/silicone oil suspension undergoes a transition from Newtonian to Non-Newtonian fluid with the application of E. Aerosil 200/silicone oil suspensions exhibit a shear thinning behaviour and also shows a plateau region at low shear in shear stress-shear rate curve with applied E. In contrast, there is no response shown by liquid-like Aerosil R972/silicone oil suspension with applied E.