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Structure-Property Relationships of Architectural Coatings by Neutron Methods

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Architectural coatings formulations are multi-component mixtures containing latex polymer binder, pigment, rheology modifiers, surfactants, and colorants. In order to achieve the desired flow properties for these formulations, measures of the underlying structure of the components as a function of shear rate and the impact of formulation variables on the structure is necessary. We have conducted detailed measurements to understand the evolution under shear of local microstructure and larger scale mesostructure in model architectural coatings formulations by small angle neutron scattering (SANS) and ultra small angle neutron scattering (USANS), respectively. The SANS results show an adsorbed layer of rheology modifier molecules exist on the surface of the latex particles. However, the additional hydrodynamic volume occupied by the adsorbed surface layer is insufficient to account for the observed viscosity by standard hard sphere suspension models (Krieger-Dougherty). The USANS results show the presence of latex aggregates, which are fractal in nature. These fractal aggregates are the primary structures responsible for coatings formulation viscosity. Based on these results, a new model for the viscosity of coatings formulations has been developed, which is capable of reproducing the observed viscosity behavior.