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Colloidal Aggregate Structure under Shear by USANS TIRTHA CHATTERJEE, ANTONY K. VAN DYK, VALERIY V. GINZBURG, ALAN I. NAKATANI, The Dow Chemical Company — Paints are complex formulations of polymeric binders, inorganic pigments, dispersants, surfactants, colorants, rheology modifiers, and other additives. A commercially successful paint exhibits a desired viscosity profile over a wide shear rate range from 10^{-5} s^{-1} for settling to $>10^4$ s^{-1} for rolling, and spray applications. Understanding paint formulation structure is critical as it governs the paint viscosity profile. However, probing paint formulation structure under shear is a challenging task due to the formulation complexity containing structures with different hierarchical length scales and their alterations under the influence of an external flow field. In this work mesoscale structures of paint formulations under shear are investigated using Ultra Small-Angle Neutron Scattering (rheo-USANS). Contrast match conditions were utilized to independently probe the structure of latex binder particle aggregates and the TiO_2 pigment particle aggregates. Rheo-USANS data revealed that the aggregates are fractal in nature and their self-similarity dimensions and correlations lengths depend on the chemistry of the binder particles, the type of rheology modifier present and the shear stress imposed upon the formulation. These results can be explained in the framework of diffusion and reaction limited transient aggregates structure evolution under simple shear.

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