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Dynamics of Vorticity Aligned Structures in Attractive Colloidal Suspensions[1] AJAY NEGI, Department of Chemical Engineering, Yale University, MICHELLE BEBRIN, Department of Chemical Engineering, Mcgill University, Canada, CINEDUM OSUJI, Department of Chemical Engineering, Yale University
— Shear rate jumps from high to low flow rates in an attractive colloidal suspension of carbon black particles in a non-polar solvent result in the formation of transient vorticity aligned log-like structures. We study the dynamics of these elongated flocs using optical microscopy in situ with bulk rheology. The appearance of the vorticity aligned aggregates is attended by an increase in the suspension viscosity which peaks quickly and then gradually recedes with passage of time under flow. The occurrence in time of the viscosity maximum scales inversely with the shear rate applied to the system. This emergence of the peak appears to be controlled by a critical strain and rescaling in these terms produces a common response across several different shear rates. Alteration of the attraction strength between particles by the addition of surfactant severely inhibits the structure formation. We present a simple model to account for these observations.

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