FLOW AND SHEAR THICKENNING OF DENSE SUSPENIONS OF RIGID RODS

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ABSTRACT

We present the rheological response of dense suspensions and glasses of colloidal rods under nonlinear steady and oscillatory shear, follow their yielding behaviour and critically compare it with that of their spherical hard sphere counterpart. In general dense suspensions of particles often exhibit shear thickening at high shear rates/stresses. While spherical particles have been extensively studied, particle shape anisotropy can be an important factor affecting and tuning shear thickening effects. Here we investigate shear thickening in dense suspensions of silica rigid rods in a refractive index matched medium that promotes interparticle interactions through hydrogen bonding. Using a combination of rheology and confocal microscopy we decipher the role of particle orientation in the continuous and discontinuous shear thickening regime. Our study reveals that both in continuous and discontinuous shear thickening regime there is no change in rod orientation while strong fluctuations and presence of "rheochaos" are not observed contrary to findings in other systems. Therefore, it is possible that frictional contacts between closely packed rods in a flow aligned state can induce discontinuous shear thickening at very high shear stresses without the need for reorientation effects to take place.

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