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Order transition in non-colloidal Couette suspension flows:effects of external torques KYONGMIN YEO, MARTIN MAXEY, Division of Applied Mathematics, Brown University — Suspensions of non-colloidal particles in Couette flows are investigated by using the force-coupling method. It is observed that a hexagonal order begins to develop near the wall at a volume fraction as low as $\phi = 0.48$, while the suspensions in the center of the channel remains disordered. The ordering transition depends on the ratio of the channel width to the particle radius. It is shown that the order state can be modified by applying external torques on the particles. The hexagonal order of the particles is weakened by the negative torque, leading to the increase of the shear viscosity. The positive torque has a favorable effect on the ordered state. However, if the magnitude of the positive torque exceeds a certain threshold, the hexagonal order begins to be weakened. On the other hand, at a moderate volume fraction ($\phi = 0.40$), the external torques do not have a significant effect on the suspension rheology. The nonlinear responses of rheological parameters, such as the shear and vortex viscosities, to the external torques are investigated.

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