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Dynamics of particle migration in a channel flow of viscoelastic fluids[1] GAOJIN LI, Purdue University, GARETH MCKINLEY, Massachusetts Institute of Technology, AREZOO ARDEKANI, Purdue University — Understanding the dynamics of particle transport in channel flows is important for many problems related to industrial, environmental and biological applications. Cross streamline migration of particles due to inertial and/or viscoelastic effects has been studied and utilized for particle focusing, particle separation and fluid mixing in microfluidic devices. Most previous studies on viscoelastic-induced particle focusing are limited to low Reynolds number flows and some of the mechanisms leading to particle migration remain unclear. In this work, we numerically study the interio-elastic migration of particles in a microfluidic channel flow driven by a constant pressure gradient. Simulations cover the following range of parameters: Reynolds numbers $4 \leq \mathrm{Re} \leq 100$, Weissenberg numbers $0 \leq \mathrm{Wi} \leq 2$, for weakly viscoelastic fluids with elasticity numbers $0 \leq \mathrm{El} = \mathrm{Wi}/\mathrm{Re} \leq 0.2$. Both viscoelasticity and shear-thinning effects are considered. The competition between inertia and viscoelasticity leads to different equilibrium particle positions between the channel centerline and the wall. The equilibrium position moves towards the centerline at higher El for a given Reynolds number due to the dominance of the cross-streamline viscoelastic force compared to the inertial lift. Shear-thinning effects increase the effective shear rate, and consequently, the dominance of the inertial lift drives the particle towards the wall.

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