

Migration of Buoyant Mono- and Bi-Disperse Suspensions in Low Reynolds Number Pressure-Driven Pipe Flow

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Suspensions of neutrally buoyant particles in low Reynolds number, pressure-driven flows migrate from regions of high to low shear. When the particle density does not match that of the suspending fluid, buoyancy forces as quantified by a dimensionless buoyancy number, determines the particle distribution. We use electrical resistance tomography (ERT) to visualize and quantify particle migration in pressure-driven pipe flow of monodisperse suspensions of dense or light particles and bidisperse suspensions of heavy and almost neutrally buoyant particles. The images reveal greater particle segregation at higher buoyancy numbers for the suspensions. Experiments with bidisperse suspensions reveal enhanced resuspension of the heavier particles. In addition for some flow conditions an adverse density gradient is observed with heavy suspension above light. Additionally, ERT imaging captured the developing concentration profile, revealing a complex evolution to fully developed flow. The particle distributions are reasonably well-predicted by a suspension transport model.

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