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Direct Numerical Simulations of Particle-Laden Turbulent Channel Flow ANAND SAMUEL JEBAKUMAR, Purdue University, KANNAN PREMNATH, University of Colorado, Denver, JOHN ABRAHAM, San Diego State University — In a recent experimental study, Lau and Nathan (2014) reported that the distribution of particles in a turbulent pipe flow is strongly influenced by the Stokes number (St). At St lower than 1, particles migrate toward the wall and at St greater than 10 they tend to migrate toward the axis. It was suggested that this preferential migration of particles is due to two forces, the Saffman lift force and the turbophoretic force. Saffman lift force represents a force acting on the particle as a result of a velocity gradient across the particle when it leads or lags the fluid flow. Turbophoretic force is induced by turbulence which tends to move the particle in the direction of decreasing turbulent kinetic energy. In this study, the Lattice Boltzmann Method (LBM) is employed to simulate a particle-laden turbulent channel flow through Direct Numerical Simulations (DNS). We find that the preferential migration is a function of particle size in addition to the St. We explain the effect of the particle size and St on the Saffman lift force and turbophoresis and present how this affects particle concentration at different conditions.

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