

Three-Dimensional Numerical Simulation of Drops Suspended in Poiseuille Flow: Effect of Reynolds Number

Authors : A. Nourbakhsh

Abstract : A finite difference/front tracking method is used to study the motion of three-dimensional deformable drops suspended in plane Poiseuille flow at non-zero Reynolds numbers. A parallel version of the code was used to study the behavior of suspension on a reasonable grid resolution (grids). The viscosity and density of drops are assumed to be equal to that of the suspending medium. The effect of the Reynolds number is studied in detail. It is found that drops with small deformation behave like rigid particles and migrate to an equilibrium position about half way between the wall and the center line (the Segre-Silberberg effect). However, for highly deformable drops there is a tendency for drops to migrate to the middle of the channel, and the maximum concentration occurs at the center line. The effective viscosity of suspension and the fluctuation energy of the flow across the channel increases with the Reynolds number of the flow.

Keywords : suspensions, Poiseuille flow, effective viscosity, Reynolds number

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