BRANCHING CHANNEL FLOWS OF CONCENTRATED SUSPENSIONS MEASURED BY NMRI

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In the current literature, only a few studies provide experimental data or modeling calculations for concentration and velocity fields of concentrated suspensions flowing in complex geometries [e.g. 1-3]. These flows are often encountered in materials processing applications such as injection molding and extrusion. One example of a practical complex geometry is a branching, or bifurcation, flow. Previous work on the behavior of dispersed particles in branching flows has generally emphasized the interesting finite-size case where the particle diameter is close to the branch width [4]. Meanwhile, a high loading of small particles, where the suspension can be compared to a continuum material, and the resulting impact on the concentration and flow fields have not received as much attention.

In our study, suspensions of neutrally buoyant, noncolloidal spheres in Newtonian liquids undergo steady, pressure-driven flow in a rectangular channel (4:1 aspect ratio) that divides into two symmetric or asymmetric branches at a T-junction. Particle concentration and velocity profiles are obtained by nuclear magnetic resonance imaging (NMRI). We aim to determine the effect of the branching ratio and geometry on the observed concentration and flow fields, for particle volume fractions of 0.4-0.5 and low flow and particle Reynolds numbers. Measurements include dividing streamlines and concentration inhomogeneities between the two branches. Recent results from branching flow experiments will be presented, along with comparisons to previously obtained axisymmetric contraction-expansion flow data.

References

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