

Flow visualization of concentrated particulate suspensions in capillary flow

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Concentrated particulate suspensions show complex flow behaviors which are not observed in dilute suspensions. To analyze the complex flow behaviors of concentrated suspensions in capillary flow, a conventional capillary rheometer was modified. Using the modified capillary rheometer, in-situ flow visualization with precise measurement of rheological properties was performed. The flow of concentrated alumina suspension was visualized at various flow rates. And the flow was compared with theoretically calculated flow profile of Newtonian fluid or shear thinning fluid. At the same time, shear stress was measured and analyzed. It was found that the flow behaviors observed in visualization and shear stress were correlated. The concentrated alumina suspension showed two types of flow behavior. One is plug flow and the other is shear banded flow in which lower flow rate was exhibited near channel wall unlike Newtonian fluid or shear thinning fluid. The stress was also divided by two regions depending on shear rate. The shear banded flow was observed in the stress plateau region and plug flow was observed in the region where stress increases monotonically.