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Shear flows of dense suspensions: flow modification by particle clustering and mixing BERNHARD VOWINCKEL, MEITAL CARMI, EDWARD BIEGERT, ECKART MEIBURG, Univ of California - Santa Barbara —

We investigate numerically the behavior of sheared, dense suspensions of neutrally buoyant particles, for finite Reynolds number values. This type of problem is of particular interest for multiple applications in environmental, mechanical as well as process engineering such as debris flows, slurries, and pneumatic conveying in pipelines. Controlling channel flows laden with dense suspensions is very important as it can result in jamming of the channel, hence, lowering the efficiency of a hydraulic facility. It was observed that there exists a regime for which a small increase in shear force can cause a drastic, discontinuous increase of the effective viscosity of the mixture. This abrupt transition is commonly referred to as discontinuous shear thickening. We carry out phase-resolved numerical simulations to understand the modification of the flow on the grain scale in full detail allowing for improved definitions of threshold conditions. As the properties of the carrier fluid remain unchanged during the simulation, the thickening must be caused by the disperse phase, for example, by effects of changes in spatial particle distribution, clustering, and mixing. We provide a detailed statistical analysis to answer this question.

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