Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

A study of locking phenomenon of elliptical particle in shear flow with DNS ZHIZHONG DING, Louisiana State University; Shell Company, CHENGUANG ZHANG, MIT, SHASHANK TIWARI, Louisiana State University, JYESHTHARAJ JOSHI[1], Institute of Chemical Technology, Mumbai, KRISHNASWAMY NANDAKUMAR, Louisiana State University, INSTITUTE OF CHEMICAL TECHNOLOGY, MUMBAI COLLABORATION, LOUISIANA STATE UNIVERSITY COLLABORATION — The understanding of the dynamics of arbitrary shaped particle(s) under shear flow is of great importance in design and scale-up Chemical Engineering equipment. In this study, we have carried out a series of numerical experiments on an elliptical cylinder particle, subjected to a 2D shear flow for moderate shear-based Reynolds number. The simulations have been performed using an in-house code Signed Distance Field - Immersed Boundary Method (SDFIBM) (Zhang et al., 2018). The degrees of freedom of the particle is limited and thus allows the particle to rotate only about a fixed position in space. Any translational and vertical movements are strictly limited to phase out the noises. This work demonstrates that there are two stages for elliptical cylinder particle in shear flow: the periodical rotating stage and stationary stage, divided by a critical Reynolds number. We further extend our investigation to include the effects of changing particle aspect ratio, flow confinement size and distance of particle from the wall. Frequency domain analysis have been carried out on the data to develop a better understanding of the locking phenomenon. The effect of a second ellipse in the vicinity of primary particle and its impact on the locking phenomenon has also been included.

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Date submitted: 19 Sep 2019 Electronic form version 1.4