Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Regimes of heat transfer in particle suspensions[1] ALI YOUSEFI, Department of Mechanincs - KTH Royal Institute of Technology, MEHDI NIAZI ARDEKANI, Department of Chemical Engineering - Stanford University, FRANCESCO PICANO, Department of Industrial Engineering - University of Padova, LUCA BRANDT, Department of Mechanincs - KTH Royal Institute of Technology — We present results of interface-resolved simulations of heat transfer in suspensions of finite-size neutrally-buoyant spherical particles for solid volume fractions up to 35% and bulk Reynolds numbers from 500 to 5600. An Immersed Boundary-Volume of Fluid method is used to solve the energy equation in the fluid and solid phase. We relate the heat transfer to the regimes of particle motion previously identified, i.e. a viscous regime at low volume fractions and low Reynolds number, particle-laden turbulence at high Reynolds and moderate volume fraction and particulate regime at high volume fractions. We show that in the viscous dominated regime, the heat transfer is mainly due to thermal diffusion with enhancement due to the particle-induced fluctuations. In the turbulent-like regime, we observe the largest enhancement of the global heat transfer, dominated by the turbulent heat flux. In the particulate shear-thickening regime, however, the heat transfer enhancement decreases as mixing is quenched by the particle migration towards the channel core. As a result, a compact loosely-packed core region forms and the contribution of thermal diffusion to the total heat transfer becomes significant once again.

[1]This work was supported by the grants and allocations: ERC-2013-CoG-616186, TRITOS, VR 2014-5001, SNIC and by the National Infrastructure for HPC and Data Storage in Norway (project no. NN9561K).

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Date submitted: 03 Aug 2020 Electronic form version 1.4