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Numerical study of heat and mass transfer in inertial suspensions in pipes.[1] MEHDI NIAZI ARDEKANI, LUCA BRANDT, KTH Royal Institute of Technology — Controlling heat and mass transfer in particulate suspensions has many important applications such as packed and fluidized bed reactors and industrial dryers. In this work, we study the heat and mass transfer within a suspension of spherical particles in a laminar pipe flow, using the immersed boundary method (IBM) to account for the solid fluid interactions and a volume of fluid (VoF) method to resolve temperature equation both inside and outside of the particles. Tracers that follow the fluid streamlines are considered to investigate mass transfer within the suspension. Different particle volume fractions 5, 15, 30 and 40% are simulated for different pipe to particle diameter ratios: 5, 10 and 15. The preliminary results quantify the heat and mass transfer enhancement with respect to a single-phase laminar pipe flow. We show in particular that the heat transfer from the wall saturates for volume fractions more than 30%, however at high particle Reynolds numbers (small diameter ratios) the heat transfer continues to increase. Regarding the dispersion of tracer particles we show that the diffusivity of tracers increases with volume fraction in radial and stream-wise directions however it goes through a peak at 15% in the azimuthal direction.

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