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Particle size distribution effects in an irradiated turbulent gas-particle mixture MONA RAHMANI, GIANLUCA GERACI, GIANLUCA IACCARINO, ALI MANI, Center for Turbulence Research, Stanford University — The effects of particle size distribution on thermodynamic and hydrodynamic behavior of solid particle solar receivers, that involve a turbulent mixture of gas and particles in a radiation environment, are investigated, using DNS with point particles. The turbulent flow is seeded with monodisperse and polydisperse particles, where the mass loading and total frontal area of particles are matched between the two systems. The results show that the variability of the Stokes number for polydisperse particles can significantly influence the particle clustering, and consequently the thermal performance of the system. In all cases studied, the preferential concentration is less pronounced for polydisperse as opposed to monodisperse particles. This reduced preferential concentration results in less heating of the particles, but more efficient energy release to the gas phase. Due to their different clustering patterns, polydisperse particles influence the Taylor scale of the flow in the turbulent gas phase. Polydispersity also implies variable thermodynamic and hydrodynamic properties of the particles. Our results show that the thermal behavior of the system with polydisperse particles is set by the integral measures for particle and gas momentum and thermal relaxation times.

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