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Consistent modeling of interphase turbulent kinetic energy transfer in particle–laden flows YING XU, SHANKAR SUBRAMANIAM, Iowa State University — This work is concerned with the mathematical modeling of particle-laden turbulent flows. An important term that needs to be modeled in turbulent two–phase flows is the interphase transfer of turbulent kinetic energy (TKE). Here we show that the sum of the transfer of turbulent kinetic energy (TKE) between the solid particle phase and the carrier fluid phase must equal the product of the mean slip and the mean interphase momentum source term. In the limit of zero mean slip this sum is zero, and the interphase TKE transfer is conservative, i.e., equal in magnitude but opposite in sign. We show that this constraint arises because of the interface boundary condition that requires the velocities in both phases to be the same at the interface, and because the instantaneous momentum transfer between the phases is equal and opposite in sign. This observation has important implications for modeling both the interphase TKE transfer term as well as the dissipation rate of TKE in the fluid phase. Representative multiphase turbulence models are analyzed from this perspective.

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