MS4S_12361

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Transport Coefficients of a Fluid at Nanoscale

Xiao-Bing Mi, Allen T. Chwang

Department of Engineering Mechanics, Tsinghua University, Beijing, China

The generalized theoretical expressions for the transport coefficients of a nanofluid are presented in this paper. The Chapman-Enskog functional perturbation method is employed to solve the derived Enskog-like integro-differential kinetic equation which describes the dynamical behavior of a fluid at nanoscale. The analytical solutions for the nanofluid viscosity, thermal conductivity and other nominal transport coefficients are acquired according to the reduced transport equation and classical definitions in fluid mechanics. The molecular dynamics (MD) simulation is further used to verify the theoretical results via the model of a Lennard-Jones fluid in a nano Couette flow. The nanofluid transport coefficients are calculated by considering both the weak and strong fluid-wall interactions. By comparing theoretical results to MD simulations, it is found that both are in qualitative agreement in the present study.

View the extended summary