Prediction of Viscosity of a Gas-Particle Mixture

Mao-Gang He [C, S], Hou-Da Xu and Ya-Jing Yang
State Key Laboratory of Multiphase Flow in Power Engineering, Xi'an Jiaotong University, Xi'an, Shaanxi, China

The viscosity of gas-particle mixture is an important thermophysical property for understanding fully transport phenomena of non-homogeneous gas-particle flow in industry processes. The viscosity prediction methods for pure gas, pressure effect algorithms, mixing rules and the particle correction methods were compared firstly in the present work. A method that combines the corresponding state method Lucas, Reichenberg pressure effect algorithm, Reichenberg mixing rule with Vladimir Vand amendment expression is proposed. By using new method, the viscosity of gas-particle mixture can be evaluated from the physical parameters of pure components and their volume fraction or mass fraction. The mixing rule has the biggest influence on the viscosity of the gas-particle mixture. Considering that the Reichenberg mixing rule neglects the effect of induced dipole and quantum, the necessary corrections was made on the Reichunberg mixing rule. The maximum deviation of new method to estimate the viscosity of gas-particle mixture is below 3.5 % and the average deviation is under 1 % comparing with the experiment data. Then predictions were performed for $H_2/H_2O/CO/CO_2/HCl/N_2$ gas mixture with MgO particles.