Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

A non-equilibrium multi-component evaporation model for blended diesel/alcohol droplets. HONGYUAN ZHANG, PING YI, SUO YANG, University of Minnesota — A non-equilibrium Langmuir-Knudsen model for multi-component pure diesel and blended diesel/alcohol droplets and sprays is developed. This model takes into account most of the key processes during the droplet lifetime, including the finite heat conduction and limited mass diffusion inside the droplet, the differential diffusion in gas phase, and the non-equilibrium Langmuir-Knudsen evaporation law for multi-component droplets. The present model shows good agreements with experimental measurements for pure ethanol, diesel, and blended diesel/ethanol droplets. The non-equilibrium effects become significant when the initial droplet diameter is smaller than 20 μm, and these effects are enhanced with increasing ambient temperature and forced convection intensity. The non-equilibrium effects are more significant for the blended diesel/alcohol droplets than pure diesel, especially during the evaporation period of ethanol. The present evaporation model has also been applied to calculate the evaporation processes of single- and multi-component fuel sprays under various ambient conditions. The non-equilibrium effects for the blended diesel/alcohol sprays are significant in terms of the fuel vapor component concentrations.

Suo Yang
University of Minnesota

Date submitted: 31 Jul 2019 Electronic form version 1.4