Abstract Submitted for the DFD11 Meeting of The American Physical Society

Modeling Coupled Particle/Fluid/Thermal/Charge/Ion Transport with a Hybrid Lattice Boltzmann and Immersed Boundary Method MIAO WANG, PhD student, YING SUN, Assistant Professor — A hybrid model based on lattice Boltzmann method and immersed boundary method is developed to simulate complex transport processes in semi-solid flow batteries, where electrode slurries are composite of both electrolyte and electrode particles flowing through an electrochemical reaction zone. In such a case, the coupled charge and ion transport need to be solved in a moving frame of reference, accounting for the motion of electrode particles. The model is first validated by studying the sedimentation of non-isothermal particles in a fluid domain, where the hydrodynamic forces are determined by the lattice Boltzmann equation and the immersed boundary method is used to solve for heat transfer. The hybrid model is then applied to solving for the species and ion transport in both the electrolyte and electrode particles inside semi-solid electrode slurries. The charge/ion transport properties as a function of particle volume fraction and particle size of the electrode material are presented.

> Miao Wang PhD student

Date submitted: 05 Aug 2011

Electronic form version 1.4