Sukkee Um et al., J Nanomed Nanotechnol 2015, 6:4
http://dx.doi.org/10.4172/2157-7439.S1.022



# Lattice Boltzmann modeling of random nano-transport phenomena in highly disordered carbon felt composite layers

**Sukkee Um, Seungho Shin** and **Ah-Reum Kim**
Hanyang University, South Korea

A three-dimensional lattice Boltzmann model has been developed to visualize the nano transport phenomena in highly disordered carbon felt layers for advanced electrochemical energy systems and to search for effective transport properties of porosity and tortuosity in the randomly structured porous materials. Stochastic nano-scale percolation modeling based on the Monte Carlo method is developed by using random number generation processes over a carbon porous domain as a population. As an initial step of the stochastic procedures, a representative elementary area (REA) is chosen through a deterministic approach with relative gradient errors. Random distributions of binary components (i.e., carbon felts and pores) are then generated by the Monte Carlo method with initially given superficial volume fractions. In a subsequent step, a cluster labeling process with a modified Hoshen-Kopelman algorithm is performed to group locally inter-connected neighboring network nodes into a single cluster. After the post-determination process of the successful connectivity, the effective mass velocity are computed to determine the extent of possible electrochemical reactions at an opposite boundary of the composite diffusion media. The model is compared with numerical data by using a commercial CFD software. In particular, a detailed statistical analysis with a 95% confidence level is conducted to deduce the statistical variations of effective transport properties in the carbon felt composite layers and to suggest the best possible scenarios for mass transfer.

## Biography

Sukkee Um has completed his PhD and Postdoctoral studies from the Electrochemical Engine Center at the Pennsylvania State University, USA. He worked for Hyundai motor company as a Senior Research Engineer and performed various researches at Korea Insitutue of Energy Research in South Korea. Currently, he is the Director of Multi Transport Energy Laboratory (METLAB) at Hanyang University, Seoul, South Korea. His expertise is in the field of computional engineering optimization and design of electrochemical energy systems..

sukkeeum@hanyang.ac.kr

**Notes:**