Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Enhancement of Electrical Conductivity in Multicomponent Nanocomposites. XIAOJUAN NI, CHAO HUI, NINGHAI SU, FENG LIU, Univ of Utah — To date, very limited theoretical or numerical analyses have been carried out to understand the electrical percolation properties in multicomponent nanocomposite systems. In this work, a disk-stick percolation model was developed to investigate the electrical percolation behavior of an electrically insulating matrix reinforced with one-dimensional (1D) and two-dimensional (2D) conductors via Monte Carlo simulation. The effective electrical conductivity was evaluated through Kirchhoff's current law by transforming it into an equivalent resistor network. The percolation threshold, equivalent resistance and conductivity were obtained from the distribution of nodal voltages by solving a system of linear equations with Gaussian elimination method. The effects of size, aspect ratio, relative concentration and contact patterns of 1D/2D inclusions on conductivity performance were examined. Our model is able to predict the electrical percolation threshold and evaluate the conductivity for hybrid systems with multiple components. The results suggest that carbon-based nanocomposites can have a high potential for applications where favorable electrical properties and low specific weight are required. We acknowledge the financial support from DOE-BES (No. DE-FG02-04ER46148).

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Date submitted: 29 Nov 2016 Electronic form version 1.4