Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Estimation of Porous Medium Tortuosity Directly from Flow Path Lines SURYANARAYANA PAKALAPATI, ISMAIL CELIK, West Virginia University — A thorough understanding of transport processes inside porous materials is vital for improving the efficiency of energy devices such as fuel cells and batteries. Continuum simulations of porous media make use of parameters such as porosity and tortuosity to account for the influence of the actual pore geometry and orientation on the transport processes. In most studies the tortuosity is treated as an adjustable parameter which is calibrated to match the predictions with the experiments. In this study a direct method is utilized to estimate the tortuosity of a porous medium. The actual geometry of a fuel cell electrode is obtained from an experimental study where the porous structure is reconstructed from slice images. The detailed geometry of porous medium is used to simulate fully resolved fluid flow through the pores. Stream lines are then generated which show the actual paths taken by the fluid flowing through the porous medium. The lengths of these path lines are then used to calculate the tortuosity of the porous medium by employing the actual definition of the tortuosity. It is shown that the tortuosities obtained in this way are smaller than the typical values reported in literature.

Suryanarayana Pakalapati
West Virginia University

Date submitted: 04 Aug 2013 Electronic form version 1.4