Abstract Submitted
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Application of method of volume averaging coupled with time resolved PIV to determine transport characteristics of turbulent flows in porous bed[1] VISHAL PATIL, JAMES LIBURDY, Oregon State University — Turbulent porous media flows are encountered in catalytic bed reactors and heat exchangers. Dispersion and mixing properties of these flows play an essential role in efficiency and performance. In an effort to understand these flows, pore scale time resolved PIV measurements in a refractive index matched porous bed were made. Pore Reynolds numbers, based on hydraulic diameter and pore average velocity, were varied from 400-4000. Jet-like flows and recirculation regions associated with large scale structures were found to exist. Coherent vortical structures which convect at approximately 0.8 times the pore average velocity were identified. These different flow regions exhibited different turbulent characteristics and hence contributed unequally to global transport properties of the bed. The heterogeneity present within a pore and also from pore to pore can be accounted for in estimating transport properties using the method of volume averaging. Eddy viscosity maps and mean velocity field maps, both obtained from PIV measurements, along with the method of volume averaging were used to predict the dispersion tensor versus Reynolds number. Asymptotic values of dispersion compare well to existing correlations. The role of molecular diffusion was explored by varying the Schmidt number and molecular diffusion was found to play an important role in tracer transport, especially in recirculation regions.

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