Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Transition to turbulence in randomly packed porous media: energy and mixing characteristics REZA M. ZIAZI, JAMES LIBURDY, Oregon State University — Transition to turbulence in randomly arranged porous media is observed in nature in applications such as cardiovascular, respiratory and biological systems. The mechanisms driving the transition to turbulence through these flows are not very well identified. This work describes the parameters influencing on overall mixing during the transition process from the perspective of energy and dispersion characteristics by addressing the following questions: (a) what are the dominant mechanisms for energy growth emanating from swirl as opposed to turbulent kinetic energy budget, and (b) how does the inertial effects of vortical structures enhance the flow transport properties such as tortuosity and dispersion. Using time-resolved PIV, flow structures are investigated in the range of macro-scale Reynolds numbers from 100 to 1000 to show the pore- versus macro-scale effects on the energy of flow and swirl structures, turbulence production and dissipation, as well as dispersion, and their contribution in interpreting the overall flow mixing. We also show Lagrangian mixing characteristics based on Eulerian local pore velocity variances and relate these to macro-scale bed characteristics for uncovering the transitional processes in randomly distributed porous media flows.

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Date submitted: 31 Jul 2019 Electronic form version 1.4