Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Optimization of Porous Medium Structure to Enhance Heat Transfer in Microchannel MOHAMMAD ZARGARTALEBI, ANNE BENNEKER, University of Calgary — Local overheating is a significant barrier in the optimal performance of cutting-edge miniature electronic devices. A promising technique for heat removal is using porous medium embedded microchannel heat sinks (MCHS). This work focuses on heat transfer optimization in MCHS by using a layered heterogeneous porous medium represented via columns of different pin sizes, using the lattice Boltzmann method. A combination of qualitative analysis of flow dynamics, temperature profiles and quantitative analysis is presented. We find that heat transfer in the system is a strong function of flow characteristics which are significantly altered by heterogeneous porous media. These porous media result in superior heat transfer when compared to homogeneous media because of different flow patterns. Particle tracing studies are done to monitor the complex flow geometry responsible for heat transfer enhancement. Typically, improved heat transfer characteristics are accompanied by an increase in resistance to fluid flow. We show that, depending on the order of the different layers of the porous medium, the heat transfer can be increased while the fluid flow resistance is reduced, allowing for an optimization of the porous medium structure, which is unprecedented in previous MCHS studies.

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Date submitted: 22 Jul 2019 Electronic form version 1.4