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Flow Physics and Thermal Transport at Superhydrophobic Walls

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ABSTRACT:

Superhydrophobic (SH) surfaces consist of the combination of nano- or microscopic surface patterning with a hydrophobic coating. Such surfaces dramatically alter the interfacial dynamics between liquid and solid phases and subsequently yield flow physics and thermal transport behavior that is markedly different from a traditional smooth hydrophilic surface. Liquid in contact with a SH surface wets only a fraction of the solid surface, provided the pressure is not too high. Subsequently, large reductions in the overall flow resistance can be achieved and apparent velocity and temperature discontinuities exist at the plane of the surface. SH surfaces find application and importance in self-cleaning surfaces, frost mitigation on aircraft or wind turbines, high efficiency condensers, solar cell glass, etc. This presentation will address the dynamics and thermal transport associated with liquid interacting with SH surfaces. Specifically, we will consider the influence SH surfaces exert on the overall flow and convective thermal transport characteristics for impinging droplets, liquid jet impingement, two phase flows, and single phase microchannel flows. General trends will be discussed in terms of the important surface and dynamical non-dimensional parameters.

BIOGRAPHY:

Professor Maynes is Chair of the Department of Mechanical Engineering at Brigham Young University where he has been on the faculty since 1997. He received his Ph.D. from the University of Utah, where, prior to his appointment at BYU he was a post-doctoral research professor and instructor. He received the B.S. and M.S. degrees in Mechanical Engineering from Utah State University in 1992 and 1993, respectively. Other experience includes employment with the Space Dynamics Laboratory and Argonne National Laboratory. He has published extensively on the research he has directed, being an author on over 190 scientific papers and presentations. During his time at BYU he has advised 37 graduate students and over 60 undergraduate researchers and has directed over six million dollars in externally sponsored research contracts and grants. At BYU he has received numerous University, College, and Department teaching and research awards. He is a Fellow of ASME and an Associate Editor for the ASME Journal of Fluids Engineering. When he is not teaching engineering or conducting research he enjoys climbing mountains, cycling, running, fly-fishing, and spending time with his family.