MECHANICAL ENGINEERING SEMINAR

Additively Manufactured MicroChannels for Heat Exchange

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Abstract

Recent technological advances in the field of additive manufacturing (AM), particularly with direct metal laser sintering (DMLS), have increased the potential for creating novel heat exchange components. Using DMLS broadens the design space and allows for increasingly small and complex geometries to be fabricated with little increase in time or cost. Challenges arise when attempting to evaluate the advantages of DMLS for specific applications, particularly because of how little is known regarding the effects of surface roughness, which is inherent in the AM process. This presentation shows resulting pressure drop and heat transfer measurements of flow through as produced microchannels that have been manufactured using DMLS in an effort to better understand resulting roughness effects. Results presented also show the effect of build direction and channel shape on the roughness as well as build tolerances. Results showed significant augmentation of these parameters compared to smooth channels, particularly with the friction factor for microchannels with small hydraulic diameters. However, augmentation of Nusselt number did not increase proportionally.

Biography

Dr. Karen A. Thole is a Distinguished Professor and Head of the Department of Mechanical and Nuclear Engineering at The Pennsylvania State University. She is the founder of the Steady Thermal Aero Research Turbine Laboratory (START) lab, which focuses on gas turbine heat transfer and is a center of excellence for a major turbine engine manufacturer. She has published over 200 archival papers and advised 70 dissertations and theses. She currently serves on the ASME Board of Governors. Dr. Thole co-founded the Engineering Ambassadors, which is a professional development program with an outreach mission. She was recently recognized as SWE's 2014 Distinguished Engineering Educator and in 2015 with ASME's George Westinghouse Gold Medal and the Edwin F. Church Medal. She holds two degrees in Mechanical Engineering from the University of Illinois, and a PhD from the University of Texas at Austin.