Using Anisotropic Micro/Nano-Structured Surfaces to Manage Condensate on Heat Exchanger Surfaces

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ABSTRACT: In many energy conversion and power generating systems, simultaneous heat and mass transfer occurs at surfaces where a metallic substrate is in contact with a gas and liquid. Commonly, this occurs when water condenses from moist air onto a heat exchanger or is sprayed onto a heat exchanger in an evaporative cooler. How water wets the heat transfer surface can dramatically affect air-side heat transfer and pressure drop. In this presentation, the wetting states on rough surfaces will be discussed, and how wettability affects the retention of water on heat exchangers will be reviewed. The use of anisotropic wettability will be proposed. Results from wettability experiments with microgrooved surfaces will be presented, including placed droplets, condensed droplets, and melt water retained after melting frost. A model of droplet retention on microgrooved surfaces will be presented and reviewed. A range of related topics, including current work on dynamic contact angles, nano-scale surface modifications, and liquid-infused surfaces will be discussed.

BIO: Anthony M. Jacobi completed his PhD at Purdue University and then spent three years on the faculty of the Johns Hopkins University before joining the University of Illinois at Urbana-Champaign. He has been on the faculty at Illinois since 1992, where he is currently Head of Mechanical Science and Engineering and the Richard Kritzer Distinguished Professor. His research is on heat and mass transfer, fluid mechanics, and thermodynamics in energy systems, and much of his work is directed at air-conditioning, refrigeration, and power generating systems.