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Designing Energy-Efficient Heat Exchangers— Creating Micro-Channels on the Aluminum Fin Surface[1] JIA YING, ANDREW SOMMERS, KHALID EID, Miami University, Oxford, OH — In this research, a method for patterning micro-channels on aluminum surfaces is described for the purpose of exploiting those features to affect the surface wettability. Minimizing water retention on aluminum is important in the design of energy-efficient heat exchangers because water retention can deteriorate the performance of such devices. It increases the air-side pressure drop and can decrease the sensible heat transfer coefficient thereby increasing energy consumption and contributing to higher pollution levels in the environment. Photolithography is used to create the micro-scale channels and a hydrophobic polymer is used to reduce the surface energy of the aluminum plates. Droplets are both injected on the surface using a micro-syringe and condensed on the surface using an environmentally-controlled chamber. A ramé-hart goniometer is used to determine the advancing and receding contact angles of water droplets on these modified surfaces, and a tilt-table assembly is used to measure the critical inclination angle for sliding. Our results show that droplets placed on these patterned surfaces not only have significantly lower critical inclination angles for sliding but are easier to remove from the surface at low air flow rates. Efforts to model the onset of droplet movement on these surfaces using a simple force balance relationship are currently underway.

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