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Fluorescence Thermometry Characterization of Microchannel Cooling Performance with Sidewall Heating TAE JIN KIM, Stanford University, CARLOS HIDROVO, Northeastern University — Microchannel cooling of complex circuitry in microelectronics and LOC systems is an area of continued research that is constantly evolving. As such, it is important to properly evaluate the heat removal efficiency of the microchannels in near wall heating configurations. In this talk we evaluate the cooling efficiency of microchannels with microheaters embedded on the sidewalls. The microchannels are fabricated using soft lithography and the embedded joule heaters are created by filling molten low melting temperature alloys in two satellite microchannels and solidifying them. In order to assess the thermal transport rate, fluorescent images of the fluid mixed with two temperature-sensitive dyes were captured and pre-conditioned with an image-distortion correction algorithm. By taking their ratiometric value versus temperature measurements, results show that the heat removal efficiency initially increases as a function of Re and then plateaus at about 50 percent once Re is greater than 20. This behavior is the result of a decreasing advective resistance with increasing flow rate, where the ratio of the substrate-environment resistance to the wall-fluid convective resistance determines the ultimate performance of the cooling microchannel.

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