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**Micro-scale heat transfer mechanisms of single-bubble nucleation events** SAEED MOGHADDAM, KEN KIGER, Dept. of Mech. Engr., Univ. of Maryland — The formation, growth and departure of a single bubble at the surface of a heated wall is a fundamental problem which has applications ranging from bubble micropumps and inkjet printers to cooling applications based on boiling heat transfer. The precise prediction of this phenomenon, however, is made difficult by the strong coupling of mass, momentum and energy in the vicinity of a dynamic liquid/vapor interface. Although several important mechanisms (such as microlayer evaporation, transient conduction via surface rewetting and microconvection from bubble pumping) have been identified over the last half-century, their exact contribution to the bubble growth and overall wall heat transfer has been subject to much debate even in the current literature. In order to quantitatively answer the above question, a novel multi-layer MEMS sensor array has been constructed to obtain high-resolution measurements of surface temperature and heat flux underneath a single bubble within a perfluorcarbon liquid. The result of these measurements has allowed for the detailed description of all three transient mechanisms, and a quantification of their contributions to the bubble growth and heat transfer associated with the ebullition event. Specifically, it is found that convection near the periphery of the bubble interface typically makes the largest contribution to the wall heat transfer at large superheats, followed by rewetting transient conduction and microlayer evaporation, respectively.

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