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Transient Temperature Measurements of Electrokinetically-driven Microflows[1] ZHEYAN JIN, Aerospace Engineering Dept., Iowa State University, SATOSHI SOMEYA, KOJI OKAMOTO, Dept. of Human and Engineered Environmental Studies, the University of Tokyo, HUI HU, Aerospace Engineering Dept., Iowa State University — While electrokinetically driven techniques (electroosmosis and electrophoresis) can greatly simplify fluid transport in microfluidics compared to conventional pressure-driven methods, a significant drawback is the internal heat generation (commonly referred to as Joule heating) caused by current flow through working fluid. This internal heat source can significantly increase fluid temperature and generate temperature non-uniformity in microfluidics. The performance of the microfluidics is therefore strongly affected by the temperature-dependent electrical conductivity, permittivity, and viscosity of the working fluid. In this study, we present the research progress made in our recent effort to develop and implement a novel molecular tagging thermometry (MTT) technique for the transient temperature measurements of working fluid inside microchannels to further our understanding about Joule heating and micro-scale heat transfer processes in microfluidics in order to minimize the detrimental effects of Joule heating for improved performances and extended capacities of microfluidic systems.

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