On-chip Temperature Measurement and Microthermal Analysis

Abstract: Thermal measurement and analysis are used for many applications from sensing to material identification and characterization. The bulk thermal measurement systems (DSC, TGA, TMA, ...) can be find almost in any chemical, biological and material research labs. The microfabrication enabled miniaturization has given birth to a new class of microthermal analysis systems which handle sub-microliter samples and operate with high accuracy. Aside from the sample size, the on-chip thermal measurement systems have very fast response owing to lowered thermal time constants. In the past, integrated microcalorimetry has shown potential for sensing, label-free detection, material identification and many other untapped areas.

We demonstrated the realization of microcalorimeter for measurement of (1) thermal properties (diffusivity, specific heat, ...) for ionic liquids, (2) thermal flow cytometry, (3) calorimetric detection of enzymatic reactions (blood glucose, heavy metals, ...), (4) phase transition detection in hydrogels, (5) cell metabolism at single cell level (brewery on chip), (6) localized photothermal therapy based on AuNR surface plasmon and (7) graphene temperature sensor.

Biography: Benyamin (Ben) Davaji is a postdoctoral associate in the department of electrical and computer engineering at Cornell. At SonicMEMS lab he works with Prof. Amit Lal on developing Surface Acoustic Wave (SAW) inertial sensors, SAW transformers and zero power sensor systems. Prior to joining Cornell, Ben was working with Prof. Chung Hoon Lee on microthermal analysis and thermal microfluidic systems at Nano Devices Laboratory at Marquette.

Before starting his Ph.D., he worked at Institute of Microengineering and Nanoelectronics (IMEN) at Bangi, Malaysia. At IMEN, he was part of the team developing microfluidic device for stem cell isolation and Bionic Man project. Formerly, Ben was a research assistant at modeling and simulation of semiconductors laboratory (UTCAD) working with professor Morteza Fathipour at University of Tehran, Tehran, Iran.