



Prof. Jungchul Lee

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Title:

Microchannel cantilevers beyond mass sensing applications

Abstract:

Microchannel cantilevers, one of promising physical microelectromechanical systems (MEMS) devices that have embedded microchannels, have been widely used in gravimetric sensing applications of liquids and particles introduced into the channel or dispensing/patterning applications with liquid phase materials when a dispensing nozzle is additionally configured near their free ends. Although there are numerous potential applications at elevated temperatures such as material synthesis, calorimetric measurements, and phase change mediated manipulation or control, to name a few, microchannel cantilevers are mostly used at or near room temperature mainly due to the absence of integrated active heating elements. Towards various applications under fast and quantitative temperature modulation, we have developed fluidic resonators with integrated heating capability. Heater-integrated microchannel cantilevers with or without a dispensing nozzle were batch-fabricated via sacrificial process, ion implantation, and other typical microfabrication processes. Fabricated heater-integrated microchannel cantilevers were thoroughly calibrated and characterized in a variety of coupled physical domains. Upon pulsed operations, electrothermomechanical time constants extracted from the transient resonance frequency provided a new measurement modality for thermophysical properties of the fluid contained in the microchannel. When a glycerol-water binary mixture was pulsed heated above its boiling point, atomized droplets could be spray-ejected out of the integrated nozzle.

Biography:

JUNGCHUL LEE, Ph.D.

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--RESEARCH INTERESTS

Large scale batch fabrication of nanostructures based on silicon self-assembly, Hydrogel based micro-/nanoelectromechanical systems, Materials and processing for flexible, stretchable, and wearable devices, Nanoscale 3D printing of organic and inorganic hybrids, 3D printing for biomedical applications, Multifunctional atomic force microscopy, Single molecule force/mass spectroscopy, High-precision Laser based manufacturing and metrology, Additive manufacturing

--PROFESSIONAL APPOINTMENTS

✧ Edmonton, Canada

University of Alberta 2016–2019

Adjunct Professor; Chemical and Materials Engineering

✧ Daejeon, Korea

Korea Advanced Institute of Science and Technology 2018–present

Associate Professor; Mechanical Engineering

✧ Seoul, Korea

Sogang University 2014–2018

Associate Professor; Mechanical Engineering

✧ Seoul, Korea

Sogang University 2010–2014

Assistant Professor; Mechanical Engineering