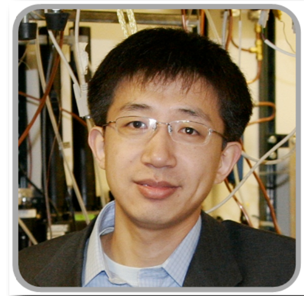
Mechanical Engineering Department Seminar

3:35pm April 15, 2015
1130 Mechanical Engineering
111 Church Street SE, Minneapolis, MN 55455

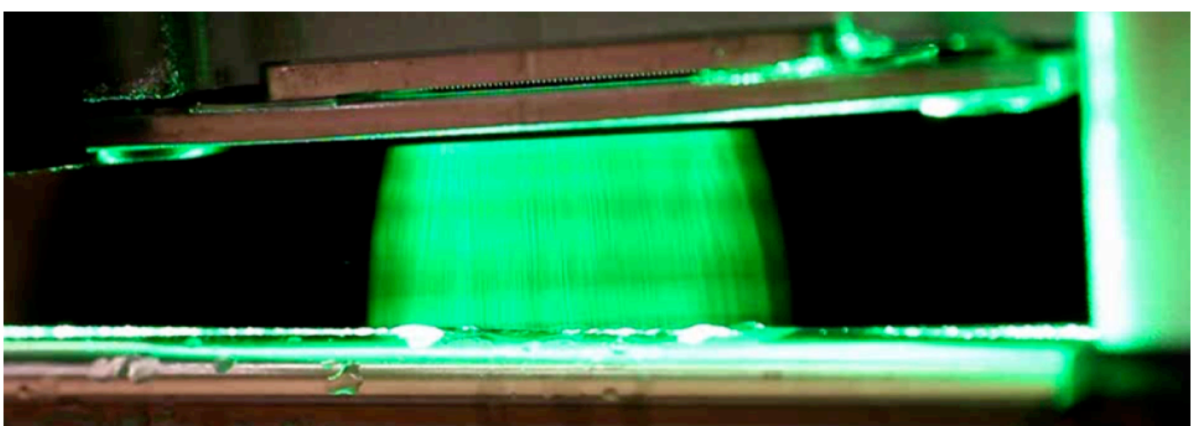


Breakup of Liquid Microjets and Its Applications in Materials Processing

Weiwei Deng

Assistant Professor, Department of Mechanical and Aerospace Engineering; University of Central Florida

The breakup of liquid jets is ubiquitous with rich underpinning physics and widespread applications. The natural breakup of liquid jets originates from small ambient perturbations, which can grow exponentially until the amplitude as large as the jet radius is reached. For unelectrified jets, only the axisymmetric perturbation is possibly unstable, and this mode is referred as varicose instability. For electrified jets, the presence of surface charge enables additional unstable modes, among which the most common one is the whipping instability that bends and stretches the charged jet. In the first part of this talk, I will report the interesting outcomes of breakup of electrified jets that undergo both varicose and whipping instabilities. The co-development of transverse and axisymmetric perturbations leads to remarkable jet breakup behavior attributable to initial perturbation magnitude, perturbation wavenumbers, and jet surface charge levels. The well-controlled triggering and co-development of the instabilities expands the possibilities of electrified jets breakup, and may spawn new ways of generating micro/nano droplets and controlled electrospinning. In the second part of this talk I will show examples of using electrospray (a result of electrified jet breakup) in processing advanced materials, such as printing ceramic sensors for harsh environments, coating of fluorine polymer with microscopic surface textures for drag reduction, and fabrication of semi-organized semiconducting polymer nano pillars with superior charge mobility and better solar cell performance.



Bio: Dr. Weiwei Deng is an Assistant Professor in the Department of Mechanical and Aerospace Engineering at the University of Central Florida (UCF). Prior to joining UCF in 2010, he was a Lecturer and Postdoctoral Researcher in the Department of Mechanical Engineering at Yale University. He received his Ph.D. in Mechanical Engineering from Yale University in 2008 and B.S. from Tsinghua University in China. Dr. Deng's general research interest is the fluid dynamics of low-dimensional liquid subjects such as droplets, jets, and films. He is also interested in additive manufacturing with the focus on using single or multiplexed electrospray to process advanced energy materials. His group's work has been featured as the cover article of Physical Review Letters. Dr. Deng is the National Science Foundation CAREER Award recipient in 2015.