

Amgen Seminar Series in Chemical Engineering
in
Cherry Auditorium, Kirk Hall, 12:45 PM

Presents Thursday, October 4, 2018

**Electric field assisted hydrodynamic studies on emulsion droplets;
from fundamental to application**

By



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We studied experimentally, theoretically, and numerically how electrohydrodynamic deformation and breakup of emulsion droplets occurs under a direct current electric field. Numerical simulation was performed by coupling Navier Stokes equation with governing equations of leaky dielectrics and interface tracking by level set method. Experiments were conducted using high speed camera and high precision voltage supplier. A single emulsion droplet breaks either before showing the slow deformation stage or rapidly. For the droplet breakup, sufficiently large Maxwell stresses are essential in comparison with the capillary pressure. For a double emulsion droplet, it shows that there are four distinct modes of breakup depending on the viscosity ratio, electrical conductivity ratio, permittivity ratio, and volume ratio of the core to shell liquid. The breakup modes are classified such as a unidirectional breakup mode, two different bidirectional breakup modes, and a tip-streaming breakup mode. These studies provide a powerful insight to manipulate and control droplets within the applicative system, e.g. microfluidic devices. We fabricated and tested the new developed modular microfluidic platform using high resolution 3D printer and show the possibility for this to apply emulsion studies and applications.

Bio: Prof. Jinkee Lee received B.S. and M.S. degrees in Mechanical Engineering from Korea Advanced Institute of Science and Technology (KAIST), Korea in 1997 and 1999, respectively, and Ph.D. degree from Brown University in 2008, where he held the prestigious Simon Ostrach Fellowship. Following his graduate studies, he was a Postdoctoral Research Fellow at jointly in School of Engineering and Applied Science and Department of Organismic and Evolutionary Biology in Harvard University from 2008 to 2009, then moved back to Brown University as an Assistant Professor (Research) in School of Engineering from 2009 to 2011. In 2012, he joined Sungkyunkwan University (SKKU), where he is currently Associate Professor and Director of Multiscale Fluid Mechanics Laboratory in School of Mechanical Engineering. His research interests is the Interfacial Flow & Transport Phenomena and their Applications falls under the area of Mechanical Engineering, Chemical Engineering, Material Science, Physics and Micro-/Nano-Technologies. He has published 49 peer-reviewed journal articles. He was a recipient of the SKKU Teaching Award 2016 awarded by President of SKKU, which is chosen by evaluating level of contribution, innovation for education and passions for teaching.

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