Shih-Kang Fan

Associate Professor
Department of Mechanical Engineering
National Taiwan University, Taiwan

Biography

Shih-Kang Fan received the B.S. degree from National Central University, Taiwan in 1996 and the M.S. and Ph.D. degrees from UCLA in 2001 and 2003, respectively. Between 2004 and 2012, he was an Assistant Professor and then an Associate Professor with the Institute of Nanotechnology and Department of Material Sciences and Engineering at National Chiao Tung University, Taiwan. Since 2012, he has been an Associate Professor with the Department of Mechanical Engineering at National Taiwan University, Taiwan. Dr. Fan is a recipient of the “TBF Chair in Biotechnology” from Taiwan Bio-Development Foundation and “Young Scholar’s Creativity Award” from Foundation for the Advancement of Outstanding Scholarship in 2014, the “Ta-You Wu Memorial Award” from National Science Council in 2012, and the “Research Award for Junior Research Investigators” from Academia Sinica in 2011. His research interest focuses on electro-microfluidics.

Multiphase Optofluidics on an Electro-Microfluidic Platform

A general electro-microfluidic (EMF) platform employing electrowetting-on-dielectric (EWOD) and dielectrophoresis (DEP) to actuate microfluids between glass plates containing proper electrodes has been developed. For the simple sandwich structure (glass/fluids/glass) without sophisticated microchannels, the EMF platform is easily fabricated, packaged, and operated. On a general EMF platform, EWOD efficiently alters the contact angle of aqueous droplets and has been widely studied in droplet actuations; while DEP drives polarizable particles and liquids by non-uniform electric fields. By skillfully integration of EWOD and DEP, we demonstrated various microfluidic functions on the EMF platform that is general to manipulate (1) fluids with diverse electric properties (water and oil droplets, gas bubbles, and plasma), (2) objects on different scales and in varied phases (mm droplets and μm particles/cells), and (3) liquids in distinct geometries (discrete droplets and continuous virtual microchannels). For the diverse material phases used on an EMF platform, exploiting the electro-optical properties of matter in varied phases is essential to reap the benefits of the optofluidic capabilities of that platform. Materials in the four fundamental phases – solid-phase dielectric layer, liquid-phase droplet, gas-phase bubble, and plasma-phase bubble microplasma – have been investigated to offer electrically tunable optical characteristics for the manipulation of fluids on an EMF platform. By combining the various materials possessing diverse electro-optical characteristics in separate phases, the EMF platform becomes an ideal platform for integrated optofluidics.

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