Title: Electro-optofluidic devices for energy and environmental applications

Sung-Yong Park, PhD

Assistant Professor
NUS Optofluidic & Energy Systems Laboratory
Department of Mechanical Engineering
Biomedical Institute for Global Health Research & Technology (BIGHEART)
National University of Singapore (NUS), Singapore
Email: mpeps@nus.edu.sg

Abstract

With technical advances in the area of microfluidics, the idea of using fluids for light control, and vice versa, has attracted great attention in recent years. This emerging research field of optofluidics combines the advantages of the two disciplines of microfluidics and optics. By utilizing microfluidic technologies that effectively manipulates the shape and position of liquid interfaces without any bulky and complex mechanical moving parts, optofluidic devices are able to adaptively control various optical performances such as focal length, reflection/refraction, and waveguide. Another advantage is to provide the smooth fluidic interface formed as a result of minimizing the surface energy of fluids. Such optical-grade smoothness of fluidic interfaces is very useful and cost-effective by eliminating the need of high-precision fabrication or polishing processes typically required for solid optics. In addition, optics itself has been effectively used to manipulate small-scale objects such as single cells, micro/nano particles, and liquid droplets without direct mechanical contact. These features make optofluidic devices more functional and reconfigurable for numerous biological and micro/nanofluidic applications.

This talk will introduce two optofluidic manipulation technologies developed in our group for past decades. The first topic will describe an optofluidic solar indoor lighting system to utilize rooftop solar energy for daylighting of buildings. The second topic will discuss about a smartphone-based environmental monitoring platform. Particularly, we will focus on a Lab-on-a-Smartphone (LOS) concept that enables automated sample preparation and microscopic detection on a portable smartphone to achieve real-time, on-site water quality detection.