Chemical Engineering

Hsien-Hung Wei

Assistant Professor

B.S.	Chemical Engineering, National Taiwan University	1991
Ph.D.	Chemical Engineering, City University of New York	2000

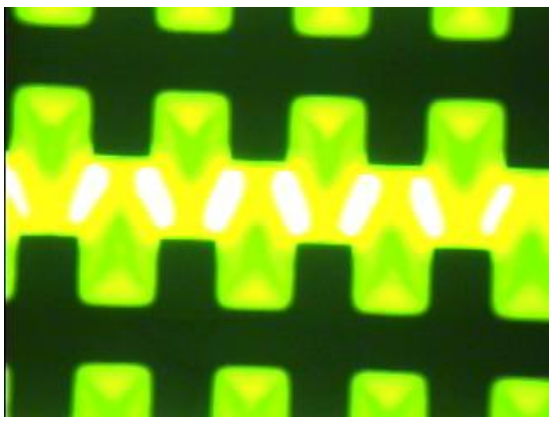
Phone	886-6-2757575 ext. 62691
Email	hhwei@mail.ncku.edu.tw
Office	Room 93916, Chemical Engineering Building

Research Interests:

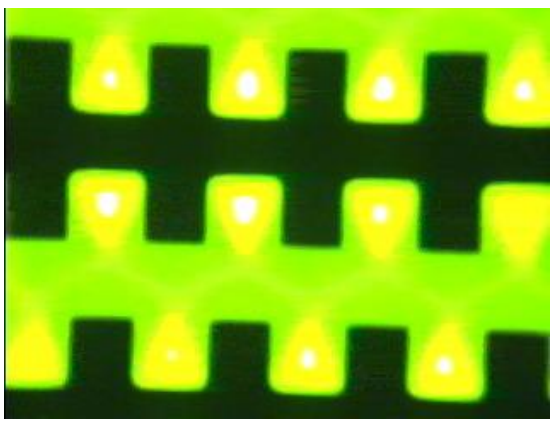
Our research group is aimed at understanding the underlying physics of various contexts in microfluidic systems so as to develop optimal strategies for applications thereof. The research focus is emphasized on the following themes.

1. Microfluidic manipulation of submicron particles

A novel microfluidic device combining pressure-driven flow and electrokinetic actuation is developed for fulfilling a variety of manipulation of submicron particles such as DNA and cells. Electrokinetic mechanisms involve electro-osmosis and dielectrophoresis. A judicious control of electric fields and applied flows can provide a new paradigm to achieve efficient separation or mixing of particles.



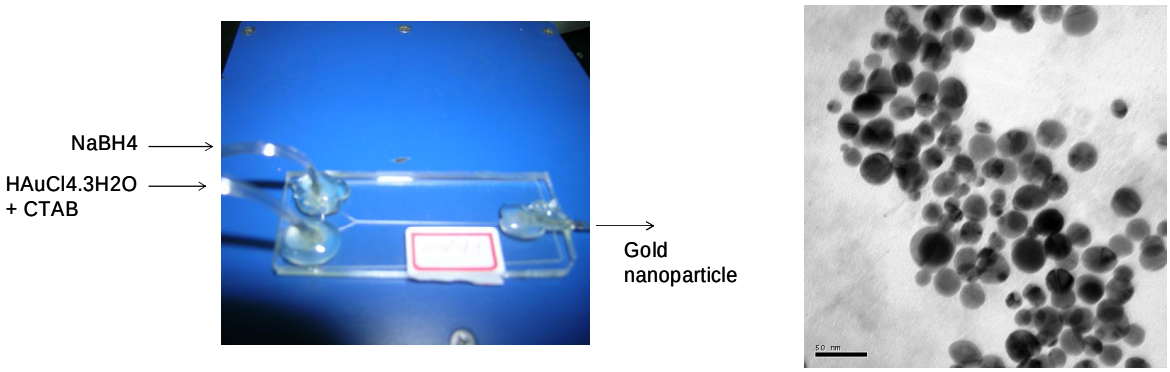
Positive dielectrophoretic particle aggregation



Negative dielectrophoretic particle aggregation

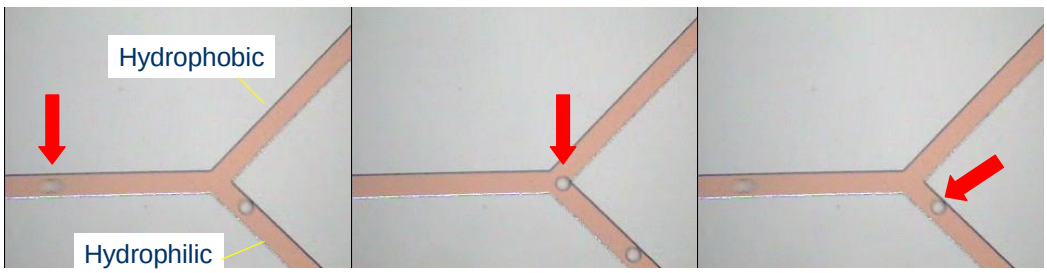
2. Microreator

A miniaturized, continuous flow device is utilized as a simple route to operations of chemical reaction processes. In addition to studying the kinetics of a given process, optimal reactor designs in concert with flow conditions are performed for a delicate control on qualities and quantities of reaction products. Moreover, it provides an advantage to integrate with other microfludic components for the subsequent separation or detection.



3. Surface-chemistry-modulated microfluidic handling

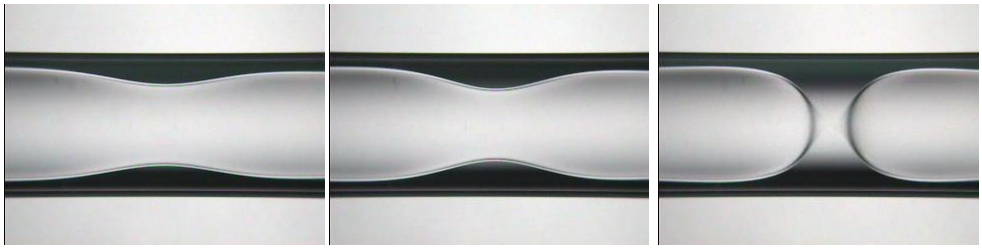
A new strategy is developed for manipulating flow and particle transport in microchannels. The theme involves selectively rendering hydrophobicity-hydrophilicity contrast in microchannels, and hence the flow features therein can alter accordingly. As a result, particles can move in a selective manner according to their affinities to the channel chemistry.



Biased drop motions created by hydrophobicity-hydrophilicity contrast in a bifurcating microchannel.

4. Hydrodynamic stability of interfacial flows

Interfacial instability is critical to micro-scale flow systems such as coating flows and airway liquid lining in view of appreciable surface tension phenomena thereof. An emphasis is put on understanding the roles of surface-active agents or fluid properties in affecting the interfacial dynamics under various flow conditions. The research can further provide guidelines so that one enables to appropriately manage instability for a desired process.



Snapshots of the interfacial dynamics of a surfactant-laden liquid film in a capillary.