Research Interests:
Chuang’s research interests range from investigation of the nature of active sites in catalysis and the reactivity of functional groups in polymeric materials to the fabrication of membranes and devices for separation and energy generation/storage. An example of his recent research is the study of interfacial cross-linking reactions of poly(vinyl alcohol)(PVA)/polyethyleneimine (PEI) composite membranes with glutaraldehyde (GA) for CO₂ and heavy metal ions separation. FTIR spectroscopy using a focal plane array (FPA) image detector allows (i) real-time determination of acetal, imine, and enamine groups and (ii) examination of bonding formation as a function of time and location. This technique reveals the effects of diffusion and concentration of functional groups on the rate of the cross-linking reactions. The later provides kinetic data for determining the optimum concentrations of monomers for synthesis of cross-linked polymer composites.

Application Focus:
Functional Membranes – Batteries, fuel cells, and separation
Organic/Inorganic Hybrids – Sorbents and dye-sensitized solar cells
Fabrication of fuel cells, solar cells, and batteries – Tape-casting, screen-printing, self-assembling, core-shell structures, and micro-and nano-scale porosity control
Unique Capabilities:
In-Situ Vibrational and Focal Plane Spectroscopy – Real time observation of catalytic and cross-linking reactions at nano- and micro-meter scale

Recent Publications/Patents: