

Evaporative Self-Assembly Approach to Complex Ordered Structures: from Polymers to Nanoparticles

Dr. Zhiqun Lin, Assistant Professor

Department of Materials Science and Engineering, Iowa State University, Ames, IA 50011

Abstract: Self-assembly of micro- and nano-scale materials to form ordered structures promises new opportunities for developing miniaturized electronic, optoelectronic, and magnetic devices. In this regard, several elegant methods based upon self-assembly have emerged, for example, self-directed self-assembly and electrostatic self-assembly. Dynamic self-assembly of nonvolatile solutes via irreversible solvent evaporation has been recognized as an extremely simple route to intriguing structures. However, these dissipative structures are often randomly organized without controlled regularity. In this presentation, I will show a simple, one-step technique based on very simple “coffee ring” phenomena to produce well-ordered structures (e.g., concentric rings, fingers, spokes, squares, triangular contour lines, ellipses, etc.) consisting of polymers or nanocrystals (NCs) with unprecedented regularity by allowing a drop of polymer or NC solution to evaporate in a curve-on-flat geometry. This technique, which dispenses with the need for lithography and external fields, is fast, cost-effective and robust. As such, it represents a powerful strategy for creating highly structured, multifunctional materials and devices.

Biography: Dr. Zhiqun Lin is an assistant professor in the Department of Materials Science and Engineering at Iowa State University (ISU). He received his PhD from the Department of Polymer Science and Engineering at the University of Massachusetts, Amherst in 2002. After a postdoctoral at the University of Illinois, Urbana-Champaign, he joined ISU in 2004. Dr. Lin’s current research activities include *Learn from "Coffee Rings": Formation of Ordered and hierarchical Structures by Evaporation-Induced Self-Assembly*; *Quantum Dots Tailored with Conjugated Polymers and Their Use in Solar Cells*; *Rational Design and Materials Engineering of Novel All Solid-State Nanocrystal-Sensitized TiO₂ Nanotube Solar Cells*; and *Phase Behavior and Phase Separation Kinetics of Polymer Dispersed Liquid Crystal (PDLC) in Nanoscopic Geometries*. Dr. Lin has authored or co-authored more than 50 peer-reviewed articles in the areas of polymer and liquid crystal mixtures, block copolymers, electrohydrodynamic instabilities, nanodynamics, surface patterning, conjugated polymer-quantum dots nanocomposites, dye sensitized solar cells. He is a reviewer for 31 journals and 6 funding agencies. He has research funding from the NSF, DOE-Ames Lab, AFOSR through ISU CNDE, University of Iowa, ACS-PRF, and 3M. Dr. Lin is a recipient of Frank J. Padden Award in Polymer Physics from American Physical Society in 2002, 3M non-tenured faculty award from 2006-2008, NSF CAREER Award in 2009. More information can be found on his research group website: <http://zqlin.public.iastate.edu/>