学术报告

题 目: Learning From "Coffee Rings": Ordered Structures Crafted by Controlled Evaporative Self-Assembly (CESA) and Flow-Enabled Self-Assembly (FESA)

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固体表面物理化学国家重点实验室
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Learning From "Coffee Rings": Ordered Structures Crafted by Controlled Evaporative Self-Assembly (CESA) and Flow-Enabled Self-Assembly (FESA)

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Abstract

Self-assembly of micro- and nano-scale materials to form well-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. In this presentation, I will show a simple yet robust technique based on very familiar “coffee ring” phenomena to produce a large variety of intriguing 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 either in a curve-on-flat geometry (i.e., a controlled evaporative self-assembly (CESA) approach) or in a two parallel-plate geometry with moving lower plate (i.e., a flow-enabled self-assembly (FESA) approach). These two techniques, which dispense with the need for lithography and external fields, are fast and cost-effective. As such, they represent powerful strategies for creating highly structured, multifunctional materials and devices.