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Aqueous Polymer in water alter the Coffee-ring effect
CHANGDEOK SEO, DAEHO JANG, School of mechanical engineering, Korea University, WONHWI NA, Department of Micro/Nano systems, Korea University, SERA PARK, SEHYUN SHIN, School of mechanical engineering, Korea University — When evaporating in droplet system, small particles move toward an edge by outward capillary flow. This phenomenon is known as coffee-ring effect. In experiments that are required to uniformly accumulate particles, this effect can be fatal. In spite of recent challenges for suppressing the coffee-ring effect, it is still insufficiently controlled in film and droplet with various solutions. For deliberate applications, various materials should be out of influence of coffee-ring effect. In this research, we used a bio-compatible and aqueous polymer, polyethylene glycol (PEG) for altering the coffee-ring effect. The influence of PEG on the evaporation of drying colloidal droplets is examined in a wide range of initial concentrations. Adding PEG to water causes a strong vortex flow near the edge of droplet and subsequently leads to significantly uniform patterns of colloidal particle deposition after evaporation. We found the vortex phenomenon by combination of radially outward capillary flow and radially inward Marangoni flows are induced by the radial variation of polymer concentration along the air?water interface. Furthermore, increasing polymer concentration significantly alters the characteristic of Marangoni Vortex and leads to reproducible patterning of conical structures.

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