Uncoupling Droplet Evaporation Kinetics and Particle Deposition on Viscoelastic Substrates

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Abstract

Droplet evaporation on viscoelastic substrates has received increasing attention over the past years because soft polymer surfaces are widely used in the ink-jet printing, biological analysis, etc. where drop evaporation is a common occurrence. However, related research focused mainly on drop spreading and surface deformation and rarely on particle deposition of suspension drop. In the present work, we carried out the experiments to investigate how the substrate softness influences the deposition patterns from evaporation of the aqueous droplets containing SiO_2 nanoparticles on PDMS. Various curing ratios of monomer to cross-linker (10:1, 20:1, 40:1, 60:1, 80:1, 100:1) were concocted to fabricate the PDMS films with different Young Moduli which were spinning coated on the glass substrate at 1000rpm. The drops evaporating in ambient environment were recorded with a CCD camera. Then, Matlab code was used to obtain the time-dependent profile information including contact angle, contact radius, drop height as well as drop volume. The particle deposition patterns were observed by laser scanning confocal microscopy (LSCM) and scanning electron microscopy (SEM). Subsequently, the effect of substrate softness on the evaporation mode and particle deposition of suspension drops is analyzed based on these data.