Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

The role of surfactant in evaporation and deposition of bi-solvent biopolymer droplets DONG-OOK KIM, ARIF ROKONI, CHUNXIAO CUI, LI-HSIN HAN, YING SUN, Drexel University — The quality of bioprinting is determined by the solvent evaporation and deposition processes of biopolymer droplets, during which instantaneous viscosity and surface tension changes occur. Such dynamics is complex and not well understood. Using high-speed interferometry and particle image velocimetry, we directly observe in real time the instantaneous drop shape and micro flows inside inkjet-printed evaporating gelatin drops containing glycerol and water. It is observed that, for bi-solvent gelatin drops with surfactants, highly viscous gelatin and glycerol accumulated near the pinned contact line at an early stage suppress the evaporation-driven outward flow and create a stagnation zone near the contact line. Lower surface tension at the contact line as compared to the drop apex induces a strong Marangoni recirculation, which in conjunction with a stagnation zone in the contact line region, causing the drop shape to transition from a spherical cap to a volcano shape during evaporation. In contrast, the suppressed evaporation outward flow together with a weak Marangoni flow leads to a dome-like deposition for the case without surfactant. The role of surfactant in polymer drop deposition with water-only solvent is also investigated and compared against that of bi-solvent drops.

Dong-Ook Kim
Drexel University

Date submitted: 30 Jul 2019 Electronic form version 1.4