Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

DNA multi-ring formation via evaporation process LU ZHANG, SIDDHARTH MAHESHWARI, HSUEH-CHIA CHANG, Y. ELAINE ZHU, Dept. of Chemical and Biomolecular Engineering, Univ. of Notre Dame — We present a study of multi-ring pattern formation of DNA aggregates during the solvent evaporation of a DNA droplet. When the contact line of a droplet is pinned at a solid substrate, a 'coffee ring' pattern is often observed due to the outward flow during evaporation which carries the nonvolatile solute to the edge of the contact line. Here we report a remarkable observation of multiple rings of DNA stain, where stretched DNA molecules connect each ring. We use a high-speed confocal scanning microscope to investigate the kinetics of the multi-ring formation, when DNAs aggregate at the contact-line and cause a stick-slip receding process with periodic depinning of the contact line. A saw-tooth pattern in measured contact angle during droplet evaporation confirms the stick-slip receding dynamics, and a miscible viscous fingering pattern further confirms the stagnation flow responsible for the formation of consecutive rings. We also report a scaling behavior of the multi-ring wavelength with DNA concentration, droplet size and evaporation temperature, consistent with our proposed mechanism.

Lu Zhang
University of Notre Dame

Date submitted: 10 Nov 2006 Electronic form version 1.4