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Contact line and bulk velocities in evaporating micron-scale droplets YI FAN, KENNETH S. BREUER, Brown University — The famous "coffee stain" phenomena is well known during the evaporation of a liquid droplet seeded with colloidal particles. However, the different phases of evaporation on a hydrophobic surface have not yet been fully explored and explained. In this experiment, evaporating micro-drops (diameter $\sim$100 μm) are seeded with 300 nm red fluorescent particles and observed from below using epifluorescent microscopy. We observed four phases: (i) steady evaporation with the contact line retreating at a constant speed of $\sim$2 μm/s; (ii) stagnation of the contact line for several seconds; (iii) a sharp transition leading to fast evaporation with a rapidly retreating contact line, and (iv) final dry-out of the film leaving the particles immobilized on the substrate. These four phases of motion, as well as the pattern of the deposited nano-particles are strong functions of both the colloidal concentration and the static contact angle. Statistical Particle Tracking Velocimetry is used to quantify the velocity fields inside the micro-drop during the evaporation history.

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