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Fluid dynamics and deposit patterns in evaporating sessile drop containing microparticles: substrate heating and wettability effects. NAGESH D. PATIL[1], RAJNEESH BHARDWAJ[2], ATUL SHARMA[3], Department of Mechanical Engineering, Indian Institute of Technology Bombay — The evaporation of sessile water drops containing colloidal microparticles is investigated on non-heated and heated hydrophilic and hydrophobic substrates. Time-varying drop shapes and temperatures of liquid-gas interface are recorded using high-speed and infrared camera, respectively. In heated case, infrared-thermography shows larger temperature gradient across the liquid-gas interface and recorded motion of the particles confirm Marangoni flow from the contact line to apex inside the drop. On non-heated hydrophilic substrates, a ring-like pattern forms, as reported extensively in the literature; while on heated hydrophilic substrates, a thin ring with an inner-deposit forms. On non-heated hydrophobic substrates, the contact line depins to form inner-deposit without ring; while on heated hydrophobic substrates, the contact line pins to form inner-deposit with thin ring. This pinning transition occurs due to the particles self-pinning in a stagnation region developed by the Marangoni flow near the contact line. This work gives fundamental insights on the thermal and wettability effects on internal fluid dynamics of the evaporating sessile drop and associated deposit shape, with applications in ink-jet printing and biosensors.

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