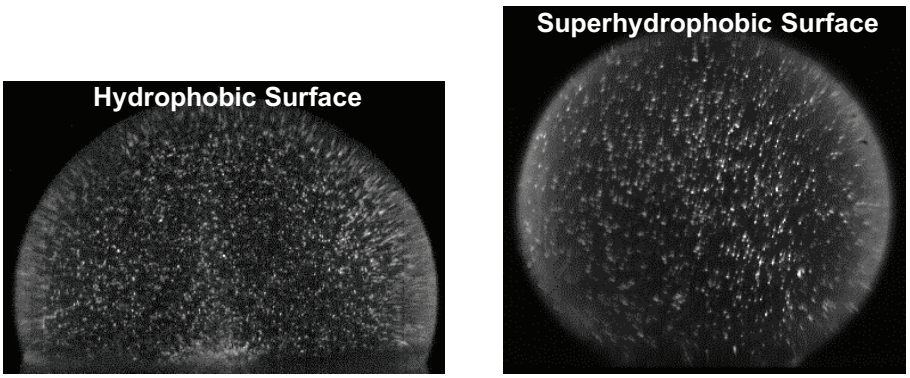
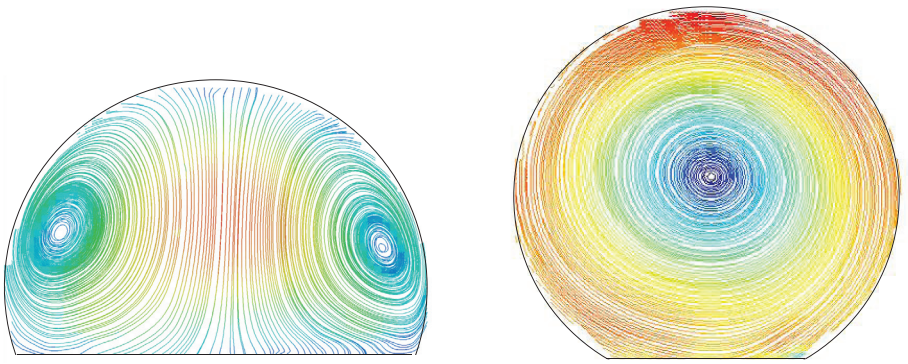
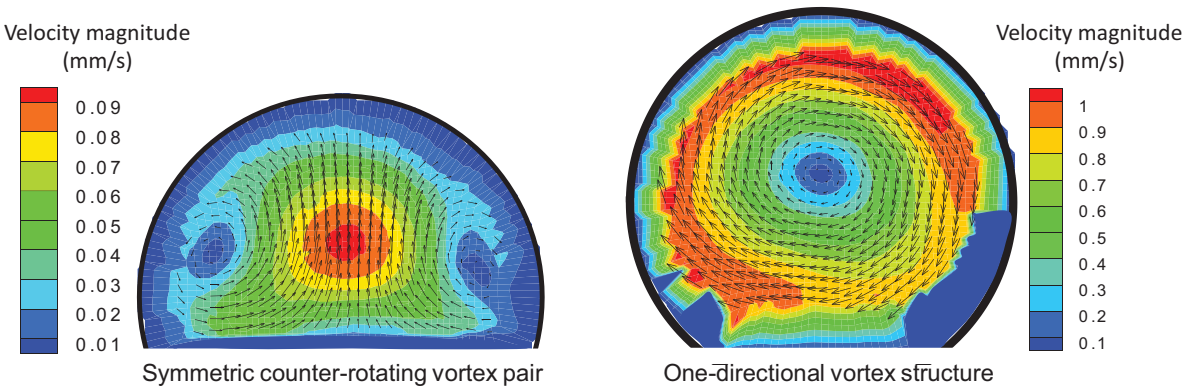


Center-plane illuminated by laser light sheet



Representative streamlines



Corrected Velocity Vectors
(Substrate Temperature = 50 °C)

Flow Visualization During Droplet Evaporation on Hydrophobic and Superhydrophobic Surfaces

Susmita Dash, Aditya Chandramohan, and Suresh V. Garimella
NSF Cooling Technologies Research Center
School of Mechanical Engineering, Purdue University, West Lafayette, Indiana, USA

The flow behavior inside an evaporating droplet on a hydrophobic (initial contact angle ~120 deg) and superhydrophobic surface (initial contact angle ~ 150 deg) is studied using Particle Image Velocimetry (PIV). Water droplets (with initial volume ~ 3 μL) are considered with suspended fluorescent polystyrene particles for visualization. An axisymmetric counter-rotating vortex pair is observed in the vertical plane of the droplet as it evaporates on the hydrophobic surface. The flow direction is upwards along the vertical axis of the droplet signifying a buoyancy-induced flow field. A single-directional vortex structure occurs in the droplet evaporating on superhydrophobic surface. An image-correction algorithm based on the ray-tracing technique is employed to correct the distortion caused due to refraction of light at the surface of the droplet, and yield an accurate quantitative estimation of the velocity vectors. Centrally localized deposition of suspended particles observed for droplet evaporation on hydrophobic and superhydrophobic surfaces as opposed to the circumferential deposition seen in the case of hydrophilic surfaces is explained in terms of the observed convection flow characteristics.