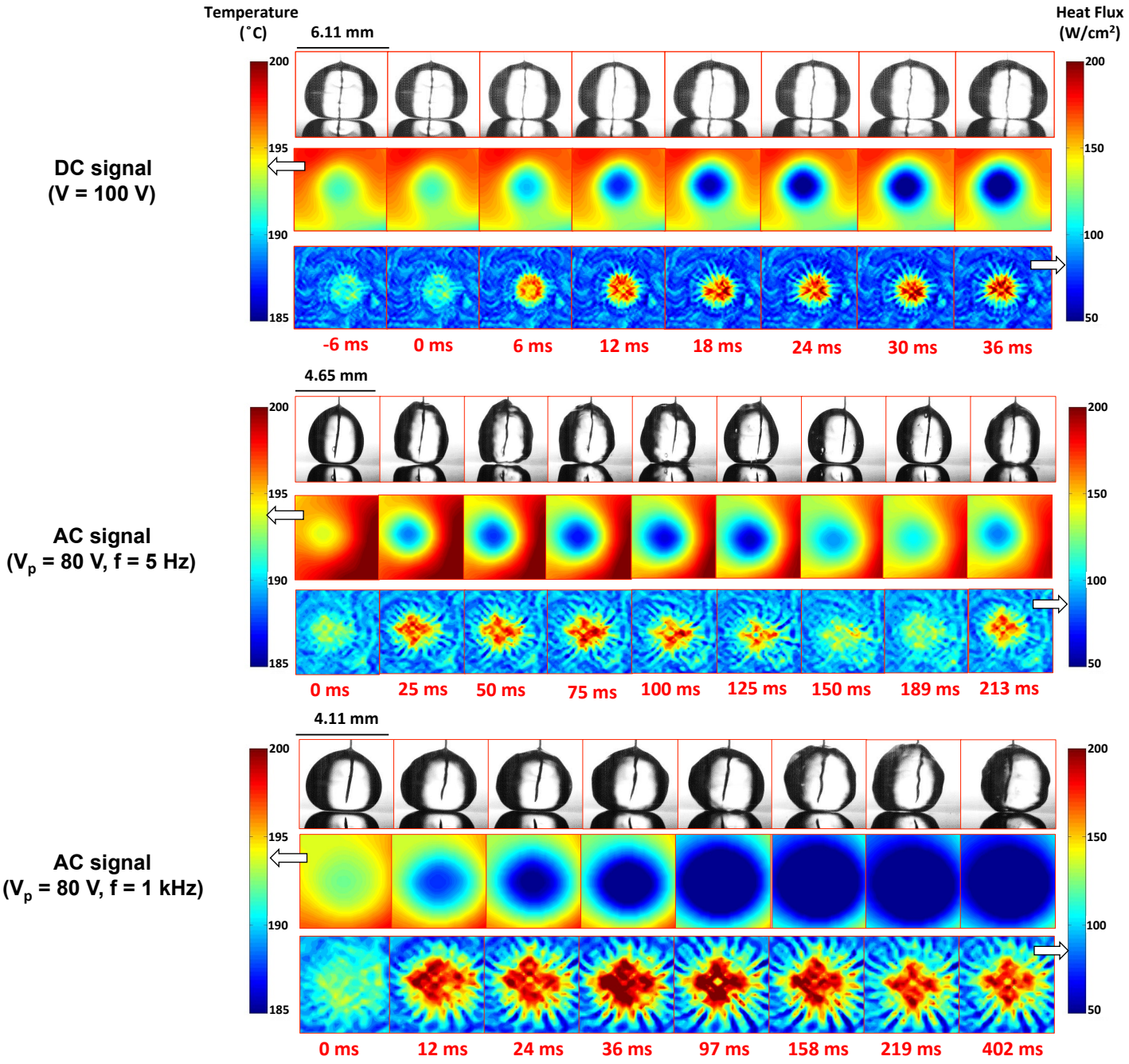

Dynamics of a Leidenfrost Droplet Modulated by Electrowetting

Yi Lu, Jiming Bao and Dong Liu

University of Houston, Houston, TX 77204

Leidenfrost phenomenon is closely related to film boiling and the critical heat flux (CHF) limit of boiling heat transfer. Understanding the mechanisms of Leidenfrost phenomenon and devising effective ways to suppress it is of great interest to the heat transfer enhancement community. In this work, a synchronized high-speed optical imaging and infrared (IR) thermography approach was employed to investigate the dynamics of a Leidenfrost droplet under the influence of electrowetting (EW). The Leidenfrost droplet was produced by dispensing a water drop on a Teflon-coated silicon wafer maintained at a wall temperature of T_{wall} = 200 ºC. Both direct-current (DC) and alternating-current (AC) electric fields were applied to induce EW effect to suppress the Leidenfrost state. The interfacial instabilities of the Leidenfrost droplet were observed, and the instantaneous temperature and heat flux distributions on the heating surface were measured. The results suggest that the electrical forces destabilize the liquid-vapor interface and cause the vapor film that insulates the heating surface from the droplet to collapse. Re-establishment of the liquid-solid contact helps to drastically improve the heat transfer, as evidenced by the reduced surface temperature and the enhanced heat flux.