INTERDISCIPLINARY CENTRE FOR ADVANCED MATERIALS SIMULATION

ICAMS Special Seminar

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Cassie state on superhydrophobic stripes: contact angles, contact line pinning, and stability

The ability of superhydrophobic Cassie surfaces to trap air at the liquid-solid interface leads to remarkable properties such as a very large water contact angle and low hysteresis. This strong hydrophobicity has macroscopic implications in the context of self-cleaning, impact processes and also microfluidic lab-on-a-chip systems since the large effective slip of SH surfaces can greatly lower the viscous drag and amplify electrokinetic pumping in microfluidic devices.

Use of highly anisotropic patterns in microfluidics makes possible well controlled optimization effective slip, robust transverse flows in superhydrophobic devices, droplet or particle sorting, or passive mixing. For part of applications the surfaces with high solid-liquid fraction of whole interface is needed. Therefore exploration of wetting on such `dense' anisotropic surfaces is a timely step in study of microfluidics-oriented superhydrophobicity.

Present research includes experimental study and qualitative theoretical assessments of the wetting effects on the superhydrophobic Cassie surfaces with stripe patterns in wide range of solid-liquid fractions. The different ways of Cassie-to-Wenzel transition (when liquid fills the cavities of the surface texture), pinning of contact line and origins of contact angle hysteresis on these surfaces will be discussed. The adhesion energy and contact line elastic deformation will be shown as critical factors affecting the wetting properties of surfaces with different values of solid liquid fraction.