Wetting and adhesive friction of soft or swollen interfaces

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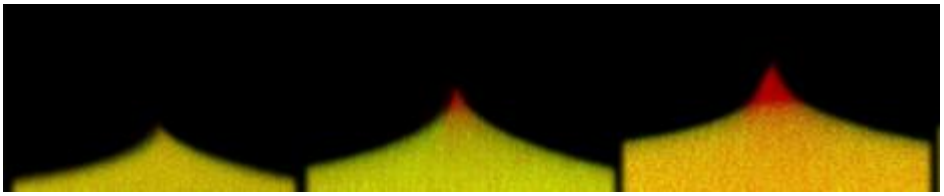

Soft materials are found in a host of applications, from biotechnology and 3D printing to adhesives and soft devices. However, understanding the behavior of soft interfaces is an ongoing challenge. When materials are sufficiently soft, or the characteristic size scale is small, crosslinked solids can display liquid-like characteristics – properties traditionally reserved for liquids emerge as an important part of the material response, like capillarity. Moreover, when the materials are swollen polymer networks, the swelling fluid can also provide true liquid behavior. In this talk, we present a situation where combinations of solid and liquid characteristics control behavior of soft deformable surfaces. In particular, we illustrate the importance of surface tensions and fluid separation for the wetting of a liquid drop on soft and swollen polymer networks. Based on confocal microscopy images, we propose a theory for fluid separation and network deformation near the contact line. In the second part of the talk, we continue to use confocal microscopy, combined with lateral force measurements, to explore how a stiff microparticle starts to move laterally on a soft, adhesive surface. Static friction behavior is not well understood, especially for soft adhesive surfaces on smaller length scales. Our current knowledge suggests that surface folds emerge when pulling the particle laterally on the surface, driven by interfacial strength and adhesion.

Short Bio. Jonathan Pham is an Assistant Professor in the Chemical and Materials Engineering department at the University of Kentucky. He received a PhD in Polymer Science and Engineering from the University of Massachusetts Amherst where he investigated nanoparticle assembly and mechanics. During this time, he was a Chateaubriand fellow at ESPCI-ParisTech exploring the deformation of microscale helical filaments by microfluidics. Prior to joining Kentucky, he was a Humboldt Postdoctoral Fellow at the Max Planck Institute for Polymer Research working on a range of topics, including cell-surface interactions and liquid drop impact. Jonathan has been recognized for his efforts in soft matter and interfaces, most recently through an NSF CAREER award, an ACS PRF doctoral new investigator award, and a 3M non-tenured faculty award.