CPP 74: Friction and Lubrication

Time: Thursday 17:00–17:45 Location: C 243

Invited Talk CPP 74.1 Thu 17:00 C 243

Multiscale Contact Mechanics for Rough Surfaces with Applications to Rubber Friction and the Leak-rate of Rubber Seals — •Bo Persson — FZ Juelich, Germany

Surface roughness has a big influence on the dry or lubricated contact between solids in stationary or sliding contact. Surface roughness often occurs over many decades in length scale, e.g., from nm to the linear size of the objects, which makes it a hard problem for numerical (e.g., finite element) methods. I have developed an analytical contact mechanics theory which can take into account all relevant length scales. The theory is very flexible and can be applied not only to homogeneous elastic solids but can include layering, plasticity and viscoelasticity (which is important for rubber-like materials). Both dry and lubricated contact mechanics, with or without adhesion, can be studied using this approach. The theory predicts the area of real contact, the distribution of contact stresses and the distribution of interfacial separations which is important for the leak-rate of seals or for microbial ingress during the shelf life of syringes. It also predicts the viscoelastic contribution to rubber friction and can be used to obtain the Stribeck curves for lubricated contacts. In this presentation I will describe the theory in some detail and give some applications to rubber friction and the leak-rate of rubber seals. See also www.MultiscaleConsulting.com for more information and relevant publications.

CPP 74.2 Thu 17:30 C 243

Motion of drops on slippery surfaces — •Frank Schellenberger, Doris Vollmer, and Hans-Jürgen Butt — Max Planck Institute for Polymer Research, Mainz, Germany

Liquid repellent, antibiofouling, pressure-stable and self-repairing surfaces would have enormous impact in industrial and medical applications. Slippery lubricant infused textured surfaces may open up novel possibilities. When a liquid drop is deposited on a slippery surface, the drop is found to slip by tilting the surface a few degrees. With the drop, dirt or also bacteria can be removed.

We used Laser Scanning Confocal Microscopy (LSCM) to observe the behavior of drops of different liquids on a lubricant infused textured surface. As textured surface we used micropillar arrays and inverse opals to hold different lubricants.

We investigated the shape of the wetting ridge surrounding a drop, the three phase contact lines, and how a drop advances and recedes on slippery surfaces. Single pinning and depinning events are resolved with micrometer and millisecond resolution. Even, cloaking of the drop is visible by using LSCM. Confocal microscopy revealed that drops on slippery surfaces have a high contact angle, typically exceeding 150°.

We expect that this understanding of the stationary and dynamic behavior or drop on slippery lubricant infused surfaces will help to design stable slippery lubricant infused surfaces.