

Molecular Simulation Studies of Low Friction and Biocompatible Zwitterionic Surfaces

Yi He, Rahul Bhowmik and Shaoyi Jiang

Department of Chemical Engineering, University of Washington

Currently, the most common solution to chronic arthritis is total joint replacement. The success of this replacement is largely dependent on the lubrication of contact surfaces of artificial joints. Despite significant progress in the understanding of molecular tribology for chemical systems, there is still a lack of a fundamental understanding of the lubrication mechanisms for water-based biological systems, especially the lubrication between zwitterionic material-coated surfaces. In this work, friction between two surfaces covered by zwitterionic polymer brushes will be studied using both molecular simulation and experimental techniques. Zwitterionic coatings will be studied and compared with PEG coatings. The major focus will be to gain insight into the origin of the friction between zwitterionic coatings at the molecular level and to investigate the relationship between friction and surface hydration. The fundamental understanding from this work will guide the design of novel biomaterials for artificial joints and other water-based lubrication systems.