Tuesday, May 21st

9:30 am, Room 8335 Chemistry

Special Materials Seminar

Department of Chemistry

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Dept. of Polymer Engineering

University of Akron

"Thickness-dependent elastic moduli of organic glass films"

For over two decades, there has been considerable controversy over changes in the glass transition temperature (T_g) of organic glasses confined in nanopores or thin (<100 nm) films. Polymer thin films can exhibit apparent decreases in T_g by over 80 K in comparison to their bulk; as T_g is typically closely coupled with mechanical, transport and electrical properties, the size dependent behavior could be critical to understanding the mechanical stability of lithographic feature for microelectronics, performance of thin polymer membranes, and aging of organic electronics as examples. In this talk, I will discuss our experimental designs to test proposed origins for the size dependent behavior based upon examination of the elastic moduli of these films through wrinkling instabilities. For small molecule glasses, I will focus on commonly utilized organic glasses for OLEDs. We find that the proximity of the test temperature to bulk T_g and the deposition conditions are critical to the thin film behavior of these small molecule glasses; processing can be applied to generate films with constant moduli irrespective of film thickness. For polymer thin films, the critical factors in controlling the thickness dependent behavior appear to be backbone rigidity, residual solvent, and quench depth into the glass. I will conclude with brief discuss of our speculative hypotheses and implications in emerging technologies.