Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Exploring the Origin of Hysteretic Memory Behavior in Polyelectrolyte Brushes VIVEK YADAV, MEGAN ROBERTSON, JACINTA CONRAD, University of Houston — Polyelectrolyte brushes attached to surfaces change their conformation when exposed to solutions of varying pH. As responsive materials, polyelectrolyte brushes are widely employed to control surface wettability, adhesion, friction, and biofouling. Many of these applications require reversible pH-switching of the surface properties, and therefore it is essential to understand brush response to variations in pH. Numerous brush properties, including contact angle and degree of swelling, exhibit hysteretic memory behavior: a response dependent on the direction of pH change. Despite widespread use of brushes, the role of polyelectrolyte brush length and dispersity in the observed hysteretic memory behavior is not well understood. Here, we synthesized poly(acrylic acid) (PAA) brushes with controlled brush length and dispersity using the grafting-from approach at a constant grafting density. We identified three trends in the response of the PAA brushes to changes in pH. First, the thickness of dry brushes decreased as the pH was decreased. Second, the water contact angle measured at low pH increased with dispersity. Finally, disperse brushes exhibited hysteretic memory behavior in the contact angle The origin of hysteretic memory is consistent with dispersity-driven pH-dependent conformational changes in these polyelectrolyte brushes. Together, these results indicate that increasing brush dispersity significantly alters the pH-response. To demonstrate the usefulness of controlling brush properties, we showed that the response of brushes to an abrupt change in solution pH was correlated to release of bacteria from the brush surface.

Vivek Yadav
University of Houston

Date submitted: 06 Jan 2017 Electronic form version 1.4