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In-situ Adhesion Measurements Utilizing Layer-by-layer Functionalized Surfaces CHRISTOPHER M. STAFFORD, ADAM J. NOLTE, JUN YOUNG CHUNG, Polymers Division, National Institute of Standards and Technology, MARLON L. WALKER, Surface and Microanalysis Science Division, National Institute of Standards and Technology — The adhesion between poly(dimethylsiloxane) (PDMS) hemispheres coated with layer-by-layer (LbL) assemblies of polyelectrolytes and rigid, planar substrates was investigated using Johnson, Kendall, and Roberts (JKR) contact mechanics. Measurements were performed against amine-functionalized glass slides both in air and in aqueous solutions of controlled pH. Despite the increased density of negatively charged carboxylate groups, LbL-functionalized PDMS exhibited lower adhesion due to the combined effects of increased surface roughness and the high Young's modulus of the coating. Measurements of coated PDMS in aqueous solutions revealed tunable adhesion behavior dominated by pH-mediated changes in the mechanical properties of the coating. Smoothing the surface of the LbL coatings by aqueous salt annealing led to a significant increase in adhesion. Our results suggest that LbL assembly can be an effective means of surface functionalization for in-situ adhesion measurements, but understanding and predicting the adhesion behavior requires comprehensive knowledge of the chemical, mechanical, and topological properties of the coating and how such properties change in response to the ambient environment.

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