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Probing the adhesion of particles to responsive polymer coatings with hydrodynamic shear stresses RYAN TOOMEY, GULNUR EFE, University of South Florida — Lower critical solution temperature (LCST) polymers in confined geometries have found success in applications that benefit from reversible modulation of surface properties, including drug delivery, separations, tissue cultures, and chromatography. In this talk, we present the adhesion of polystyrene microspheres to cross-linked poly(N-isopropylacrylamide), or poly(NIPAAm) coatings, as studied with a spinning disk method. This method applies a linear range of hydrodynamic shear forces to physically adsorbed microspheres along the radius of a coated disk. Quantification of detachment is accomplished by optical microscopy to evaluate the minimum shear stress to remove adherent particles. Experiments were performed to assess the relationship between the surface chemistry of the microsphere, the thickness and cross-link density of the poly(NIPAAm) coating, the adsorption (or incubation) time, and the temperature on the detachment profiles of the microspheres. Results show that both the shear modulus and slow dynamic processes in the poly(NIPAAm) films strongly influence the detachment shear stresses. Moreover, whether an adsorbed microsphere can be released (through a modulation in the swelling of the poly(NIPAAm) coating by temperature) depends on both the surface chemistry of the microsphere and the extent of the adsorption time. Finally, the results show that the structure of the poly(NIPAAm) coating can significantly affect performance, which may explain several of the conflicting findings that have been reported in the literature.

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