

pH-TUNING OF ADHESIVE PROPERTIES OF POLYMER COLLOID FILMS CONTAINING POLY(ACRYLIC ACID)

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Polymers or copolymers that have carboxylic acid groups are well known to be pH responsive and hence have been used to create microgels and brushes that respond to the environments. The presence of acrylic acid is known to influence the hydrophilicity of polymer colloid (latex) films, but its influence on mechanical properties is much less well understood. In this work, the effects of pH on the film formation, mechanical and adhesive properties of a poly(butyl acrylate-co-acrylic acid) latex film are investigated. The molecular interactions at the polymer/polymer interfaces are of particular interest. FTIR spectroscopy confirmed that hydrogen bonds are formed by PAA carboxylic acid groups in films cast at pH values lower than the pK_a of PAA, whereas ionized carboxylic acid groups are present in films cast at a pH above the pK_a . Macroscale tensile deformation and nanomechanical measurements with AFM force spectroscopy show that *hydrogen bonds* in the dried latex film do not affect the elastic modulus but increase the extension before failure. On the other hand, *ionic* interactions impart a high modulus and lower deformability in the dry films. Probe-tack measurements illustrate that latex films from a low-pH dispersion are more deformable and have a higher adhesion energy compared to films cast from high pH dispersions. The film nanomechanics are consistent with the observed macro-scale adhesive properties. The effects of pH-derived interface interactions on the viscoelasticity of latex films are determined by dynamic mechanical analysis. The adhesion of films cast at various pH values are explained by considering the bulk properties using a recently-developed criterion.