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Adhesion and Spatial Distribution of Water in the Presence of Moisture: Surface Chemistry Affects. CHRISOPHER WHITE, BRYAN VOGT, EMMETT OBRIEN, WEN-LI WU, NIST — Many polymer adhesive bonds experience a complete loss of adhesion above a critical threshold relative humidity value. The adhesion loss from water exposure does not generally correlate with moisture solubility of the polymer; instead the surface layer of the polymer appears to be the controlling factor in the adhesion. Here, the adhesion and spatial distribution of water of a series of PMMA-Al adhesive samples in the presence of moisture is measured with neutron reflectivity, while the adhesive strength of the joint is measured using the shaft-loaded blister test. The role of changing surface chemistry was examined to determine their effect on this interfacial moisture content. The loss of adhesive strength upon exposure to moisture correlates directly with the interfacial water content. Surface modification methods that decrease the interfacial water content are used to tune the adhesive strength in moist environments. Minimization of the interfacial water concentration does not however result in the best adhesion in moist environments as interplay between the dry adhesion and water content exists.

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