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Complex Interfaces: Gradient Libraries and Measurement Advances JOHN HOWARTER, EDWIN CHAN, NIST, JUN YOUNG CHUNG, PETER JOHNSON, NIST, JENNIFER KELLY, JOONSUNG YOON, CHRISTOPHER STAFFORD, NIST — The structure and properties of polymer interfaces play an integral role in many technological applications, particularly in the areas of coatings and adhesives. Interfacial interactions depend on factors including interfacial energy, roughness, surface chemistry, mechanical properties, and the defect population. We have developed measurement approaches that quantify the effects of these factors on interactions of soft materials at or near rigid interfaces such as found in many nanocomposites or coatings. To complement the measurement techniques, we designed combinatorial libraries that express incremental variation in key factors governing interfacial properties. There is an additional challenge of measuring and predicting degradation of material at interfaces, which can include both surface and sub-surface structures. Novel metrologies developed for this purpose include a surface indention array for measurement of creep and relaxation behavior of thin films; sub-surface AFM techniques for the detection and mechanical testing of subsurface features; multiple wrinkling based metrologies which can be used to characterize thermal and mechanical response; and cantilever peel adhesion test which is used to measure interfacial fracture toughness and anisotropic adhesion.

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