

Estimation of Mechanical Properties of Ionically Complexed Films Based on Polymer-Polymer Thin Film Bilayer Wrinkling

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Wrinkling-based measurement for mechanical properties is simple and versatile technique in determining the Young's modulus of nano composite multilayered thin films. Thermally induced surface wrinkling can take place in polymer-polymer bilayered thin films due to a difference in thermal expansion coefficients between capping layer and supporting layer. In this study, spin-assisted thin films of weakly charged polyelectrolyte multilayer were deposited on polystyrene (PS) supporting layer. After thermal treatment above the glass transition temperature of PS, wrinkles were formed by thermal instability of the film. It was investigated to predict the Young's modulus of polyelectrolyte multilayer by measuring the wrinkling wavelength that grew with time. The wavelength and amplitude characteristics of wrinkled surface on polyelectrolyte multilayers can be controlled by thickness and the degree of ionization of the polyelectrolyte pairs. In addition, this system can be useful for determining the reliable characteristic of thermal deformation behavior of the polyelectrolyte multilayers due to a formation of uniformly wrinkled structure over a large area.