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Structure, Nanomechanics and Dynamics of Dispersed Surfactant-Free Clay Nanocomposite Films XIAO ZHANG, JING ZHAO, University of Akron, CHAD SNYDER, National Institute of Standards and Technology , ALAMGIR KARIM , University of Akron, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY COLLABORATION — Natural Montmorillonite particles were dispersed as tactoids in thin films of polycaprolactone (PCL) through a flow coating technique assisted by ultra-sonication. Wide angle X-ray scattering (WAXS), Grazing-incidence wide angle X-ray scattering (GI-WAXS), and transmission electron microscopy (TEM) were used to confirm the level of dispersion. These characterization techniques are in conjunction with its nanomechanical properties via strain-induced buckling instability for modulus measurements (SIEBIMM), a high throughput technique to characterize thin film mechanical properties. The linear strengthening trend of the elastic modulus enhancements was fitted with Halpin-Tsai (HT) model, correlating the nanoparticle geometric effects and mechanical behaviors based on continuum theories. The overall aspect ratio of dispersed tactoids obtained through HT model fitting is in reasonable agreement with digital electron microscope image analysis. Moreover, glass transition behaviors of the composites were characterized using broadband dielectric relaxation spectroscopy. The segmental relaxation behaviors indicate that the associated mechanical property changes are due to the continuum filler effect rather than the interfacial confinement effect.

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