Thickness Dependent Glass Transition and Thermal Expansion Behavior of Polystyrene Films on Chemically Identical Polymer-Grafted Substrates

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The behavior of polymer films is significant factor to a variety of applications in polymer industry and science. Particularly, understanding glass transition (T_g) and coefficient of thermal expansion (CTE) of thin film has important role on polymer chain conformation of the films which is confined in 2-D geometry. Many prior studies have worked with thickness dependent thermal behavior under polymer melts and substrates and it appeared to be sensitive to interfacial interactions between the polymer substrates. In this study, we investigated CTEs at glassy and rubbery states and T_g of the polystyrene (PS) films with various thickness that were supported on PS-grafted substrates. A grafting-to method with hydroxyl end-functionalized polystyrenes (PSOHs) was used to generate PS-grafted substrates. To obtain temperature-thickness dependence of T_g and CTEs, we estimated PS films on PS-grafted substrates by in-situ ellipsometry which is modified to measure the film thickness at various temperature under vacuum.