Preparation and mechanical properties of PVA/clay and Graphene oxide (GO) layer-by-layer (LBL) films

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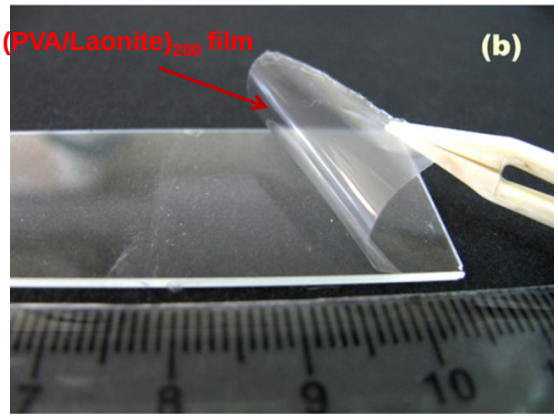
Multilayered composite films of poly(vinyl alcohol) with Laponite clay are prepared on various substrates by layer-by-layer (LBL) deposition. Multilayer growth is driven by the hydrogen bonding between poly(vinyl alcohol) and Laponite clay. We find that polymer melting due to thermal transition is largely suppressed in the LBL films, likely due to polymer chain confinement in-between clay galleries. Polymer confinement is again evidenced from the significant increase (~ 100°C) in the onset of degradation temperature shown by the LBL films compared to their conventional nanocomposite counterparts and to pure poly(vinyl alcohol) films. Compared to pure poly(vinyl alcohol), the uncrosslinked and glutaraldehyde crosslinked LBL films show significant increases in tensile strength and modulus. However, uncross-linked LBL films are found to be tougher in tension. Moreover, the mechanical properties of cross-linked LBL films are found to be less sensitive than pure PVA and than uncrosslinked LBL films to variations in relative humidity.

Further, PVA/GO multilayer films were prepared by LBL method, where GO is dispersed in Laponite suspensions in order to facilitate the layer thickness build-up. Moreover, clay is found to be a very good dispersing agent for GO. GO based LBL films show significant improvement in mechanical properties which are even higher than the mechanical properties exhibited by LBL films, prepared from PVA and clay.



Peeling off a 200 bilayer LBL film from a trichloro(1H, 1H, 2H, 2H-perfluorooctyl)silane monolayer coated glass slide