81a Novel Nanomaterials: Lbl Self-Assembly at "Soft" Interfaces

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Many applications motivate investigation of macromolecular self-assembly in two dimensions at the liquid/solid interface. In many if not most cases, however, macromolecules (e.g., proteins and polymers) also adsorb irreversibly at fluid/fluid interfaces suggesting that layer-by-layer (LBL) films can be templated at "soft" interfaces. Here we propose a novel method for creating multilayered self-assembled nanofilms by growing them layer-by-layer on a free aqueous substrate. Several samples of nanofilms consisting of alternating layers of positively and negatively charged polyelectrolytes have been successfully grown. Flow ellipsometry confirms that layer thickness evolves with time. Final film thickness depends on the number of layers (up to 100 nm for 10 consecutive layers) as well as on the specific polymer/protein chemical structure. Interfacial elasticity measurements conducted at water/air interface show that sequential adsorption at the water/air interface occurs when new oppositely charged polyelectrolyte is added into solution after complete displacement (washout) of previous adsorbate. Each polymer/protein has its own unique combination of interfacial rheological parameters. Charged nanoparticles can also be incorporated into the soft LBL film. For example, AFM images of LBL film containing colloidal gold particles sandwiched between two positively-charged Chitosan layers reveal a 2D hexagonal close packed structure formed by gold nanoparticles. A decided advantage of LBL films grown at a soft interface is that they can be easily transferred onto a large variety of material substrates.