NEXAFS Probing of Layer-by-Layer Polyelectrolyte Films

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Polystyrene Sulfonate (PSS) and Polyallylamine Hydrochloride (PAH) are predominantly used in the formation of ultra thin films of polyelectrolytes in the layer by layer self assembly method. The orientation of these polyelectrolytes on the substrate while forming thin layer of films and also the bonds if any formed between two layers of films is not well characterized. Recently NEXAFS has proved to be a very useful technique to probe the electronic structure of materials in thin films as it provides a very useful information up to a depth of 5 nm. Studies were performed probing layer by layer films with NEXAFS technique at the C K-edge, N K-edge and O K-edge. Results are reported here. The data obtained from NEXAFS experiments performed at the U7A beamline of the Brookhaven National Laboratory's National Synchrotron Light Source (NSLS) are analyzed for possible evidence of polyelectrolyte preferential alignment and interlayer covalent bond formation. Future work would be to characterize the interactions of single-walled carbon nanotubes (SWNTs) with these polyelectrolytes in layer-by-layer self-assembled films.

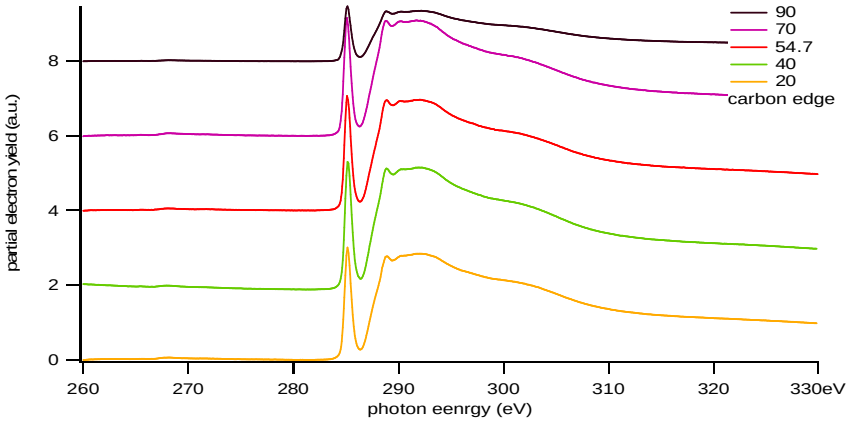

Fig. 1. Spectra of $(PSS/PAH)_{7\ bilayers}$ at carbon edge for different incident angles

References

1. Dhullipudi R.B., Lvov Y.M., Adiddela S., Zheng Z., Gunasekaran R.A., Dobbins T.A., "Noncovalent Functionalization of Single-Walled Carbon Nanotubes using Alternate Layer-by-Layer Polyelectrolyte Adsorption for Nanocomposite Fuel Cell Electrodes", Materials Research Society Symposium – Proceedings 837, paper N3.27.1 (2005).
2. Banerjee S., Benny T.H., Sambasivan S., Fischer D.A., Misewich J.A., Wong S.S., "Near-Edge X-ray Absorption Fine Structure Investigations of Order in Carbon Nanotube based systems", J. Phys. Chem. B, 8489, 109, 2005.