MSE-Colloquium@NTU

10 June 2015, 3.00pm

Lecture Theatre 3, Nanyang Technological University

Surface Characterization of Polymer Thin Films and Graphene Surfaces

Professor Chan Chi-Ming
Chair Professor, Division of Environment
Hong Kong University of Science and Technology (HKUST)

About the Talk

Thin films of bromine-terminated poly(bisphenol A octane ether) (BA-C10) were prepared using 1,2-dichlorobenzene (ODCB) and tetrahydrofuran (THF) as the solvents. The organization of the chains in these polymer films was evaluated using time-of-flight secondary ion mass spectrometry (ToF-SIMS) depth profiling. For the polymer thin films prepared using THF as the solvent, the polymer chains were in a random coil conformation as reflected by the homogeneous distribution of the Br end groups across the films. For the thin films prepared using ODCB as the solvent, the bifunctional polymer chains were folded and anchored to the substrate via their two Br end groups and a polymer brush of chain loops was formed on the substrate. As the film thickness increased, polymer chains in a random coil conformation were found to reside on the top of the polymer brush.

X-ray photoelectron spectroscopy (XPS) and ToF-SIMS were used to monitor the chemical composition of the surface of graphene before and after washing it with acetone and annealing at high temperatures. PMMA and hydrocarbon contaminants, which were detected as the major impurities, decreased as the annealing temperature increased. The atomic ratio of sp3 carbons to sp2 carbons of a clean graphene surface determined using XPS can be used to estimate the amounts of sp3 defects in graphene. ToF-SIMS spectra indicate that residual PMMA was removed from the surface of graphene at 400 oC, while hydrocarbon contaminants required a higher temperature of 500 oC to remove. In ToF-SIMS spectra obtained at 500 oC, the characteristic ions for graphene, which are related to cleavage of ring structure, include C_x^+ (x=1, 2, 3…) and $C_xH_2^{+\bullet}$ as well as C_x^- and C_xH^-. For the first time, we developed a process to produce a very clean graphene surface which was verified by ToF-SIMS and XPS analyses.

About the Speaker

Professor Chan Chi-Ming graduated from the California Institute of Technology with a Ph.D. in Chemical Engineering in 1979. He is currently the Chair Professor, Division of Environment, Hong Kong University of Science and Technology (HKUST). Professor Chan is also the Founding Director of HKUST's Interdisciplinary Program Office, as well as the co-director of the Dual Degree Program in Technology and Management.

Professor Chan has been appointed as the Advisory Professor of South China University of Technology since 1995. From 2010, he is appointed as Visiting Professor of the South Bank University, London. He is also a Fellow of the Hong Kong Institute of Engineers and the Honorary Chairman of the Society of Plastics Engineers (Hong Kong section).

Professor Chan is a renowned scientist with research expertise in advanced materials such as surface and interface science, polymer blends and alloys, conductive composite polymers, cross linking of polymers and adhesion phenomena.