

Resonant Soft X-ray Reflectivity of Organic Thin Films

At photon energies close to absorption edges in the soft x-ray range, the complex index of refraction, $n=1-\delta-i\beta$, of organic materials varies rapidly as a function of photon energy in a manner that strongly depends on the chemical moieties and functionalities present in the material. These molecular structure specific variations in the complex index of refraction can be utilized to enhance and tune the contrast in reflectivity experiments of organic films. This near edge contrast enhancement mimics the specific contrast achieved through deuterium labeling in neutron reflectivity (NR). This relatively new x-ray approach, resonant soft x-ray reflectivity (RSoXR), thus combines aspects of NR and conventional x-ray reflectivity (XR), yet does not require special chemical procedures. The capabilities of RSoXR are exemplified using a number of polymeric bi- and multilayers. A direct comparison of RSoXR to conventional x-ray reflectivity and NR for polystyrene and poly(methyl methacrylate) bilayers verifies that RSoXR is an excellent alternative tool for the characterization of organic thin films. Furthermore, applications of RSoXR such as effect of isotopic labeling, interface of conjugate polymers, thermal capillary waves at polymer/polymer interfaces will be discussed.