

Neutron Reflectivity Studies on Intermixed Interface of a Polystyrene Thin Film with the Absorbed Layer of the Random Copolymer Having the Different Molecular Composition

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In recent years, polymeric materials have been used as thin films in a wide range of applications. Generally, a spatial ratio of the surface and interface to the volume is considerably high compared to the bulk, and the contribution of interfacial interaction cannot be ignored. As a result, the thin film is unstable, and de-wetting, which is a phenomenon of film rupture from the substrate surface, often occurs. Since the de-wetting results in the loss of functionality of the thin film material, a practical way to suppress the de-wetting is required. To establish the thermal stability of thin films, we investigated modification of the silicon substrate by the adsorption of the random copolymers with the different molecular compositions, and their interfacial structure with a polystyrene (PS) thin film by using neutron reflectometry.

The adsorbed layers of the random copolymers of styrene and 2-vinylpyridine with the different compositions were prepared on the surface of silicon substrates by solvent leaching their spin-coated thin films. The interfacial structure between the adsorbed layer and the spin-coated deuterated PS thin film on it was examined before and after the thermal annealing by neutron reflectometry. The neutron reflectivity measurement was conducted on the SOFIA reflectometer at BL16, MLF, J-PARC. Fig. 1 shows the scattering length density (SLD) profiles for the deuterated PS thin film on the adsorbed layer of the random copolymer. The degree of intermixing at the interface and thermal stability of the thin film were compared for the different adsorbed layers of the random copolymers..

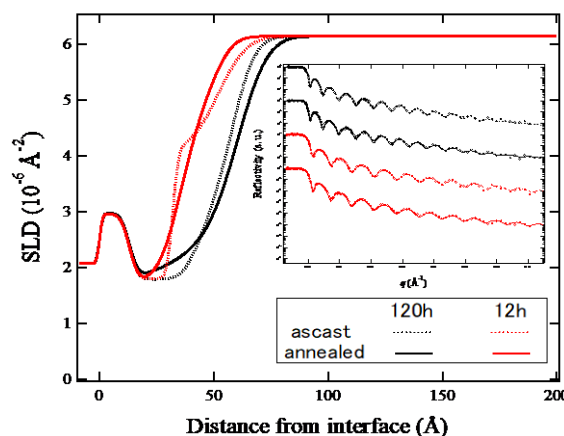


Fig. 1 The SLD profiles for deuterated PS thin film on the adsorbed layer of the random copolymer before and after the thermal annealing, obtained by model analysis on the NR profiles shown in the inset.