

A neutron reflectivity study of polymer brush layers formed by segregation of block copolymers at polymer/water interfaces

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1. INTRODUCTION

The surface properties of polymeric materials can be altered drastically by the segregation of block copolymers blended in homopolymers [1]. We have recently studied the segregation behavior of amphiphilic block copolymers such as poly(ethylene glycol)(PEG)-*b*-poly(dimethyl siloxane)(PDMS) mixed in cross-linked homo-PDMS. In this system the hydrophilic block with high surface energy avoids air surface, however, when the surface is placed in water it starts to segregate to form a water-swollen polymer brush layer. Neutron reflectometry is the most suitable method to investigate the structures of such brush layer at polymer/water interfaces.

2. EXPERIMENT

The sample films were prepared on the quartz substrates with the thickness of about 170 nm and placed on a pool of deuterated water with the film side down. Incident neutron beam was from quartz side and specular reflectivity of the polymer/D₂O interfaces was measured using ARISA-II on BL-16 of J-PARC.

3. RESULT AND DISCUSSION

The reflectivity curve and the scattering length density profile of 20 % PEG-PDMS (M_w=2100-1000) /homo-PDMS mixture film are shown in Fig. 1. We confirm the formation of D₂O-swollen PEG brush layer at the polymer/D₂O interface. The brush layer is about 16 nm in thickness. Such a clear layer has not been observed on samples which contain copolymers in lower concentrations.

REFERENCES

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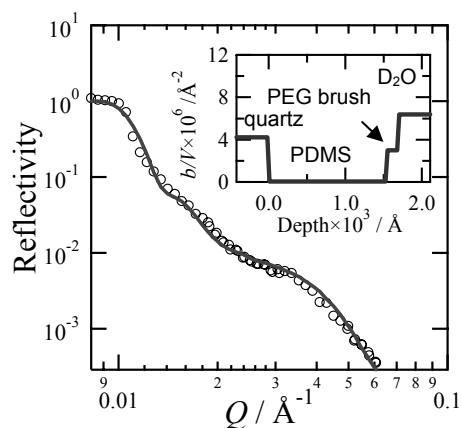


Figure 1. Neutron reflectivity of a thin film 20 % PEG-PDMS (M_w=2100-1000) /homo-PDMS mixture on a quartz substrate in contact with deuterated water. The solid line is a fit using the model depth profile of neutron scattering length density b/V shown in the inset.