

## Dynamics of diblock polymer in the form of lamellar structure

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Recently, the physical properties of spatially confined glass-forming materials were studied very much and they were focused not only from scientific point of view but also from industrial point of view because their properties were strongly related to nanotechnology. There are so many ways for the spatial confinement of glass-forming materials like porous glass, thin film, molecular sieve and so on. One of the biggest objectives in the researches for confined systems is estimation of the characteristic length scale that is responsible for glass transition. However, surface or interface effects could not be ignored with decreasing the size or scale, therefore the characteristic length scale for glass transition could not be evaluated from simple size effect only. Estimation the contribution from surface or interface effect is needed for the full understating of above problem. We have so far studied the dynamics of polymer thin films using inelastic neutron scattering method and found the decrease of mobility with film thickness. We assumed that this result was caused by the existence of low mobility layer that exist between thin film and substrate. It was expected that the interface affected the dynamics very much. In this experiment, we studied the dynamics of diblock copolymer in the form of lamella structure and focused on the motion of polymer chains that were confined in the form of lamellar structure. Compared to polymer thin films, this system is as it were, chemical confinement. We used the deuterated polystyrene (d-PS)/hydrogenated polybutadiene (h-PB) diblock copolymer (SB) with  $M_w=64k/43K$  in the former of lamellar and homo h-PB with  $M_w=43K$  as a reference sample. We studied the incoherent scattering from h-PB owing to the large scatter-

ing cross section from hydrogen compared to other atoms (C, D). The measurements were done with AGNES and the incident energy was set to 4.40 meV. First we focused on the boson peak and Fig.1(a) indicates the dynamic scattering law  $S(Q, \omega)$  at 80K. The boson peak was observed at around 2meV for both polymers. Seemingly the intensity and peak position were the same and it was considered that boson peak was not affected by confinement. Next we evaluated mean square displacement  $\langle u^2 \rangle$  for both polymers. In the low temperature region (below the  $T_g \sim 170K$  of PB), the difference was too small to observe. However, above the  $T_g$  of PB the difference was observed. The up-turn of  $\langle u^2 \rangle$  was observed for homo h-PB, indicating the onset of relaxation process, on the other hand it was not so clear for SB diblock copolymer. This indicates that the relaxation process was affected by confinement.

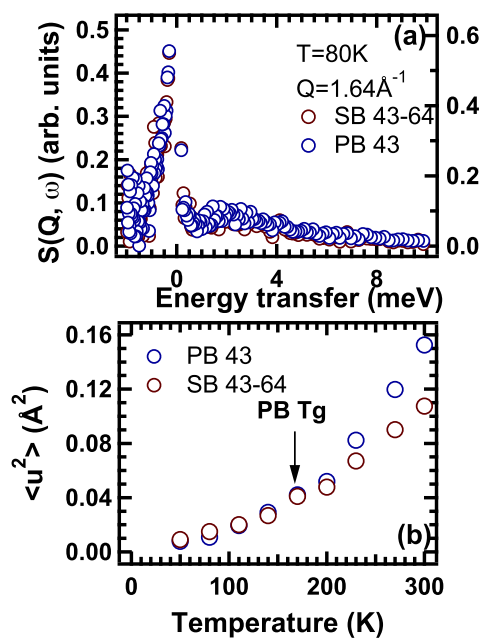


Fig. 1. (a) Dynamic scattering laws from SB and PB at 80K. (b) Temperature dependence of  $\langle u^2 \rangle$  for both polymers.