実験報告書様式（一般利用課題・成果公開利用）

（ ※本報告書は英語で記述してください。ただし、産業利用課題として採択されている方は日本語で記述していただいても結構です。 ）

| CROSS TOKAI **Experimental Report** J-PARC | 承認日 Date of Approval 2013/9/18<br>承認者 Approver Kaoru Shibata<br>提出日 Date of Report 2013/9/18 |
|---|---|
| 課題番号 Project No.<br>2012B0099<br>実験課題名 Title of experiment<br>Dynamics of Polymer Chain in Confined Space of Micro-phase Separated StructureFormed by Amphiphilic Liquid Crystal Di-block Copolymer<br>実験責任者名 Name of principal investigator<br>Takeshi Yamada<br>所属 Affiliation<br>CROSS-Tokai | 装置責任者 Name of Instrument scientist<br>Kaoru Shibata<br>装置名 Name of Instrument/（BL No.）<br>DNA / BL02<br>実施日 Date of Experiment<br>2012/12/07 - 2012/12/11 |

試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。（適宜、図表添付のこと）

Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

1. 試料 Name of sample(s) and chemical formula, or compositions including physical form.

PEO114-Azo18

PEO114-Azo51

PEO114

Az30

2. 実験方法及び結果（実験がうまくいかなかった場合、その理由を記述してください。）

Experimental method and results. If you failed to conduct experiment as planned, please describe reasons.

PEO-Az di-block copolymer consists of poly(ethyleneoxide) (PEO) and poly(methacrylate) derivative having an azobenzne moiety in the side chain (Azo). The PEO-Az copolymer forms highly ordered hexagonal cylinder structure where the cylinder is formed by the PEO. The melting and crystallization temperature are different between PEO-Az and PEO homopolymer. The PEO melting temperature was around 305K and 333 K for PEO-Azo copolymer and PEO homo polymer respectively. This indicates that the dynamics of PEO chain in the micro-phase separated structure is different from that of homo polymer. In order to reveal effects of the micro-phase separated structure, the quaielastic neutron scattering were performed in this experiment.

In this experiment, we performed elastic scan and quaielastic neutron scattering experiments for PEO114-Az18(P114A18), PEO114-Az51(P114A51), PEO114(P114), Az30(A30) in order to investigate the dynamics of PEO chain in the micro-phase separated structure.

2. 実験方法及び結果（つづき） Experimental method and results (continued)

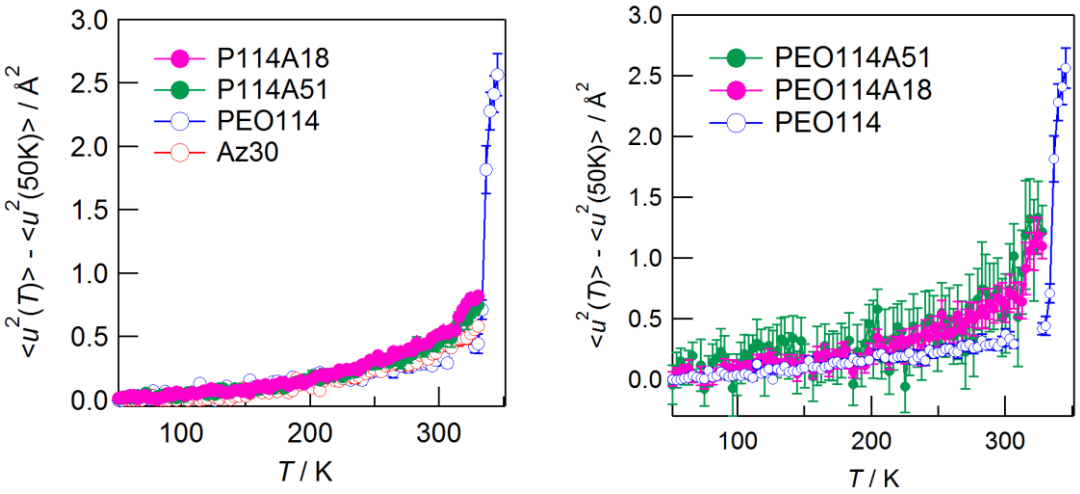


Figure 1. Mean square displacements of P114A18, P114A51, P114 and A30 (left). Mean square displacements of the PEO domain in P114A51 and P114A18 (right). The PEO homo polymer is also plotted for comparison.

Figure 1 shows mean square displacements of these polymers obtained by the BL02 spectrometer with the 3μev energy resolution. The mean square displacements of A30 slightly increased from 200K, however no jumps were observed around 305 K. The increase might be due to rotation of the methyl or methylene groups in the side chain. On the other hand, The P114A18, P114A51 and P114 showed jump around 305K and 333K respectively due to the melting of PEO crystal. The jump of P114A18 and P114A51 is smaller than that of PEO114 homo polymer because the fraction of the PEO is relatively smaller than that of PEO homo polymer. In order to estimate the contribution from the PEO chain, the mean square displacement of A30 weighted by the scattering cross-section was subtracted from those of P114A18 and P114A51. The obtained PEO mean square displacements are shown in Figure 1 (right) with the P114 homo polymer. The mean square displacement of P114A51 and P114A18 in the molten state is smaller than that of the P114 homo polymer. These results indicated dynamics of the PEO chain is restricted by the micro-phase separated structure. In order to discuss the detail, quasielastic neutron patterns will be analyzed.