CROSS TOKAI **Experimental Report** J-PARC	承認日 Date of Approval 承認者 Approver 提出日 Date of Report
課題番号 Project No. 2017A0154	装置責任者 Shinichi Takada
実験課題名 Conformation of a labeled side chain in blush-like polymers.	装置名 TAIKAN/（BL No.15） 実施日 6/3/2017 – 6/5/2017
実験責任者名 Yo Nakamura	
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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.

Hydrogenated polystyrene polymacromonomer (C8H8) with deuterium labeled side chains (C8D8) in bulk.

Carbon disulfide solutions of the above polystyrene polymacromonomer.

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.

　Deuterated polystyrene (PS) macromonomer with weight-average molecular weight M_w = 3.06 x 10^3 and hydrogenated PS macromonomer with M_w = 2.81 x 10^3 are mixed with ratios from 5 – 20 % and co-polymerized with a radical initiator to obtain brush-like polymers with deuterated-labeled side chains.

　We first measured the scattering intensities from bulk samples as shown in Figure 1, which shows the excess scattering intensities plotted against the magnitude of the scattering vector k.　The different symbols denote the different content of the deuterated side chains.　For $k < 2$ nm^{-1}, the intensity increases with increasing the content of the deuterated side chains.　The data at low scattering angles were plotted in the manner of Berry's square root plots as shown in Figure 2.　From the slope of the line fitted to each plot, we obtained 2.0 nm^2 for the mean-square radius of gyration R_g^2 of the labeled chain.　This value is close to 1.9 nm^2 for R_g^2 of linear polystyrene with M_w = 3.0 x 10^3 in cyclohexane.　This shows that the conformation of the side chain of this polymacromonomer is close to that of the unperturbed polystyrene chain.
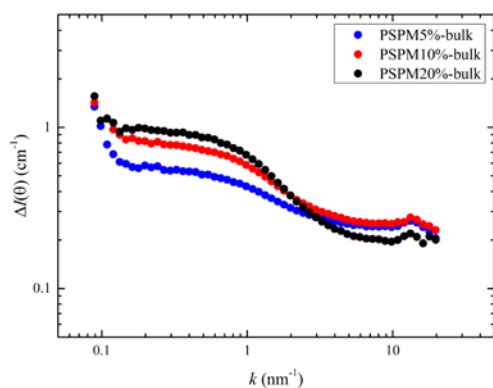
Figure 1. Excess scattering intensities from labeled side chains of polymers in bulk state.
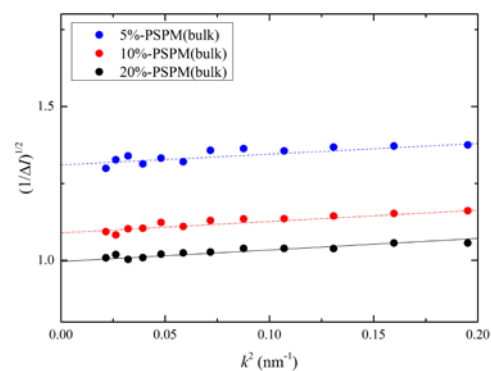

Figure 2. Square-root plots of the data in Fig.1.

   We also took measurements on the labeled polymacromonomer samples in carbon disulfide.   Since the scattering length of this solvent is close to that for polystyrene, the radius of gyration of the labeled side chains in solution is expected to be measured.   The data obtained for different polymer concentrations are shown in Figure 3.   The excess scattering intensities at low angles were analyzed by the similar method that described above.   The obtained R_g^2 was about 50 nm^2 which is much larger than the value for linear PS with $M_w = 3.0$ x 10^3.   This suggests that spacing between different side chains are included in R_g.   At higher angles, we observed a shoulder at k about 0.5 nm-1.   This is considered to be reflected the molecular spacing.
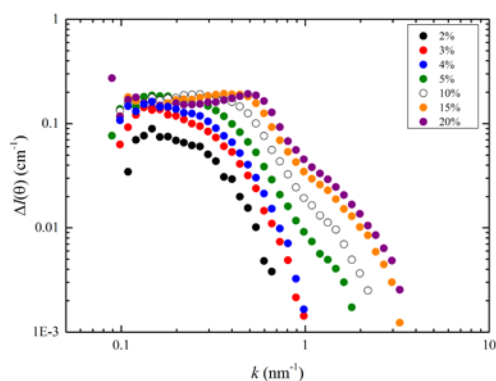

Figure 3.   Excess scattering intensities from labeled side chains in carbon disulfide solutions with different polymer concentrations.