

# Visualizing the correlation between branching point of homogeneous polymer gels

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Polymer gel is 3-dimensional network structure containing solvent. For usual polymer gel, branching point is introduced randomly. Hereby, a network structure of gel becomes heterogeneous. However, our research group succeeded in the fabrication of a very homogeneous gel recently. This gel was named "Tetra-PEG gel". (Sakai, T. et al. *Macromolecules*, 2008). Tetra-PEG gel is fabricated by combining two 4-arm poly (ethylene glycol)s which are able to react mutually. It is confirmed that Tetra-PEG gels have homogeneous structure by small angle neutron scattering. (Matsunaga, T. et al., *Macromolecules*, 2009).

In the present study, our purpose is to quantify homogeneity of Tetra-PEG gel. For this purpose, in the previous experiment, we synthesized the tetra-PEG gel with deuterium-label near the branching point and carried out SANS experiments. However, we could not observe any peaks (Figure (a),(b)). This may be because the labeled region was too small to scatter enough neutrons.

Accordingly, we planned to measure a newly designed Tetra-PEG gel polymers were crosslinked with fully deuterated linear PEG (Figure (c)). By contrast matching of deuterated PEG, we expected to observe only the correlation peak between each hydrogenated Tetra-PEG. We fabricated 3 different concentration samples: 60 mg/mL, 30 mg/mL, and 15 mg/mL. Solutions and gels were prepared each concentration. Solutions were prepared by combining non-reactive deuterated PEG and hydrogenated Tetra-PEG.

The observed SANS profiles are shown in the Figure (d). Open circles are solutions and filled points are gels. Peaks were not observed about solutions. On the other hand, about gel, peaks were appeared. This is because correlation appeared at a specific

position with forming crosslinking. These peaks become slightly broader with decreasing concentration. This is due to incomplete network, void of network structure.

We are going to analyze this result further and write the paper.

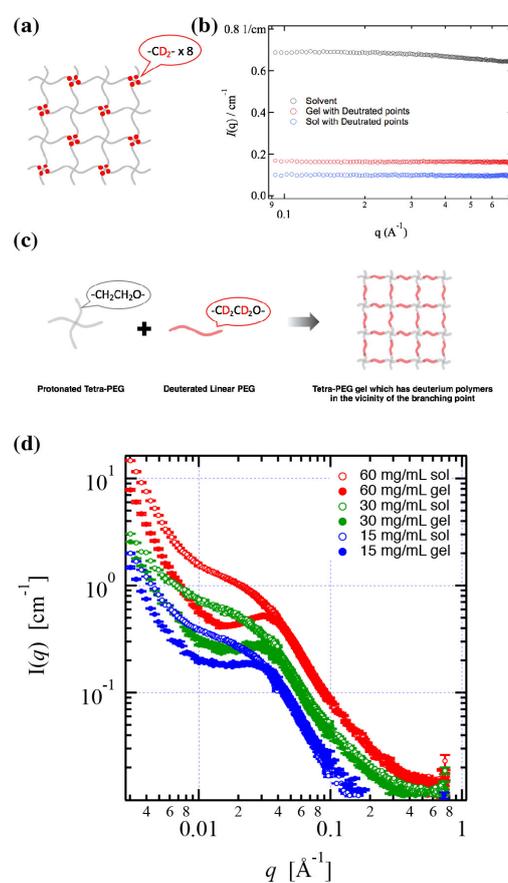


Fig. 1. (a) An illustration of Tetra-PEG gels. (b) The SANS profile in previous study. (c) An illustration of prepolymer and gels. (d) The SANS profiles of PEG gel crosslinked by deuterated polymers.