

Investigation of Microscopic Structural Changes in Poly(oligo-ethylene glycol methyl ether methacrylate)-Based Hydrogels

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Polymer hydrogels are soft and water-swollen materials. Physicochemical properties, such as polarity and softness of gels, can be changed greatly by the stimuli-responsiveness of hydrogels, which make hydrogels promising materials for the advanced applications, including controlled uptake/release and actuators. More recently, poly(oligo-ethylene glycol methyl ether methacrylate) (POEGMA)-based polymers have been developed as a new type of thermo-responsive polymer (Lutz et al., *Macromolecules* 2006, 39, 893-896.). They offer a potential alternative to the use of thermo-responsive polymers and PEG for a design of hydrogels for biomedical applications.

However, to the best of our knowledge, very few studies have been reported on the physical properties of POEGMA-based gels, especially for the volume transition during changes in temperature. So far, we have investigated the dynamics of POEGMA-based gels by dynamic light scattering (DLS) (Kureha et al., *Macromolecules* 2018, 51, 8932-8939). Here, the formation mechanism of hydrophobic domains in the gels was investigated from the slow mode in the correlation functions. The hydrophobic domains composed of polymer aggregation grew in the gels by rising temperature and they were copolymerization ratio dependent. The domain formation was suppressed as the copolymerization ratio of the longer side chain was increased.

In this study, in order to investigate the domain formation mechanism in the molecular level, we carried out a systematic study of network structural changes in POEGMA gels by small-angle neutron scattering (SANS) as a function of temperature.

SANS results of POEGMA gels show the peak (Fig. 1), which correspond to the characteristic distance between the hydrophobic domains. Moreover, with increasing temperature, the scattering contribution of the peak was gradually decreased, suggesting that the correlation of the distance between domains disappeared because the heterogeneity of the polymer network was increased due to the growth of domain.

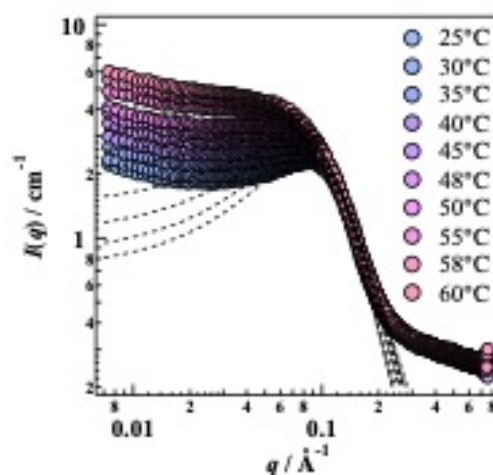


Fig. 1. Temperature dependence of SANS profiles of POEGMA-based gels.