Structural Properties Analysis of Temperature-responsive Hydrogels with Unique Nanodomains

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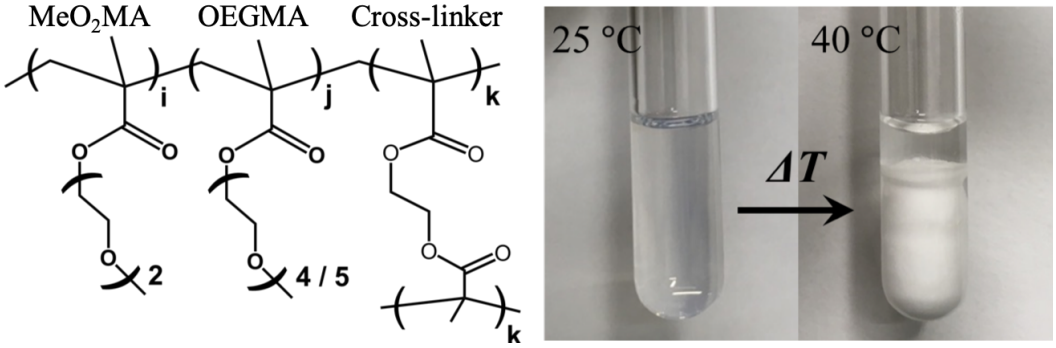
Recently, poly(oligo ethylene glycol methacrylate) (POEGMA)-based polymers have been developed as a new type of thermo-responsive polymer. They offer a potential alternative to the use of thermo-responsive polymers and PEG for the design of hydrogels for biomedical applications. POEGMA-based polymers can be synthesized via facile free radical polymerization and they display a lower critical solution temperature (LCST) in water that is governed by the ethylene oxide chain length (*n*) of the OEGMA monomer. Through the statistical copolymerization of diethylene glycol methacrylate (MeO_2MA, $n = 2$) and OEGMA ($n = 4$ or 5), copolymers can be prepared that display the LCST ranging anywhere from ~ 20 °C to ~ 63 °C (Figure). Although, many researchers have developed POEGMA-based gels for use in advanced biomedical applications, such as bioconjugates, coatings, microspheres, and injectable gels, very few studies have been reported on the physical properties of POEGMA-based gels, especially for the volume transition during changes in temperature. In this study, the structural properties of hydrogels with ethylene glycol units in their side chains were characterized by dynamic light scattering (DLS), dynamic viscoelasticity measurements, and small-angle neutron scattering (SANS).

We found that the polymer aggregate domains were formed in the gels and grew by increasing the temperature, which was observed by the dynamics of polymer networks.[1] Furthermore, the viscoelasticity of the gels was increased as the nanodomain grew, and it depended on copolymerization ratio of MeO_2MA and OEGMA.[2] From SANS analysis, we also discovered that the distance between the nanodomains was determined by the ethylene oxide chain length (*n*).



1) T. Kureha et al., *Macromolecules* **2018**, *51*, 8932. 2) T. Kureha et al., *Soft Matter* **2020**, *in press*.

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