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Mechanical properties of Tetra-PEG gels with supercoiled networks TAKUYA KATASHIMA, Univ of Tokyo, KENJI URAYAMA, Kyoto Institute of Technology, UNG-IL CHUNG, TAKAMASA SAKAI, Univ of Tokyo — We investigated the effects of swelling and deswelling on the mechanical properties of polymer gels with variable polymer volume fractions of interest (φ_{m}). We employed the Tetra-PEG gel as a model system. Tetra-PEG gels were prepared by the AB type crosslink-coupling between the two symmetrical tetra-arm prepolymers with precisely tuning the network strand length (N_{c}) and polymer fractions at preparation (φ_0). The drastic increase in the elastic modulus was observed in the high φ_{m} region due to the unusually contracted conformation of the network strands, called supercoiling. The Obukhov model can describe the φ_{m}-dependence of the elastic modulus in all φ_{m} regions. We analyzed the stress-elongation relationships for the swollen and deswollen networks. We estimated the fractal dimensions based on the Pincus blob concept, and for the first time observed the φ_{m}-, N_{c}-, φ_0-dependence of the fractal dimension. We found that the gyration radius exhibits the affine deformation in the supercoiling region. These findings will help to understand the structure and formation mechanism of supercoiling.

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