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Extracting Mechanical Properties of Fully-Extended Polymer Chains from DN Gels TAKAHIRO MATSUDA, Graduate School of Life Science, Hokkaido University, TATIANA B. KOUZNETSOVA, Department of Chemistry, Duke University, TASUKU NAKAJIMA, Faculty of Advanced Life Science and Soft Matter GI-CoRE, Hokkaido University, TAKAMASA SAKAI, Graduate School of Engineering, The University of Tokyo, TAKAYUKI KUROKAWA, Faculty of Advanced Life Science and Soft Matter GI-CoRE, Hokkaido University, STEPHEN L. CRAIG, Department of Chemistry, Duke University, JIANPING GONG, Faculty of Advanced Life Science and Soft Matter GI-CoRE, Hokkaido University — Mechanical properties of polymer chains are a basic and dominant factor of the mechanical characteristics of polymeric materials. Many studies have been attempted to understand the single chain behavior. In this study, we extracted the mechanical properties of polymer chains in the fully-extended state, such as the force-extension relationship, from analysis of the mechanical behavior of bulk double network (DN) gels. The DN gels show high strength and toughness, which originates from the energy dissipation by polymer chain scission during deformation, called internal fracture. Since the internal fracture phenomenon is observed by the mechanical hysteresis loop during cyclic tensile testing, the mechanical properties of a fully-extended polymer chain is embedded in the hysteresis loop. Here, we extracted a specific single-chain mechanical property of poly(ethylene glycol) from analysis of uniaxial cyclic tensile behaviors of DN gels. The extracted results are also compared to single molecule force-extension curves obtained by atomic force microscopy.

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