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Biaxial Strain Testing of Extremely Soft Gels KENJI URAYAMA, YOHSUKE BITOH, TOSHIKAZU TAKIGAWA, Dept. Mater. Chem., Kyoto Univ. — We present a biaxial tensile tester to characterize the nonlinear stress-strain behavior of extremely soft polymer gels with very low shear moduli, of the order of 100 Pa, under general (equal and unequal) biaxial strain. Stretching of gel sheet specimens in a solvent bath can avoid finite self-weight bending deformations that have precluded biaxial tensile experiments with such extremely soft gels. General biaxial strain covers a wide range of physically accessible deformations in contrast to conventional uniaxial strain that is only a special one among them. The biaxial data for fully swollen chemical gels reveal that the exceptional agreement of uniaxial data with predictions of the simplest rubber elasticity model (ideal gas model), which has been known for over 60 years, is superficial because the model evidently fails to describe the biaxial data. This new biaxial tester will be a powerful tool for the full characterization of the large deformation behavior of extremely soft materials, including biological soft tissues.

Kenji Urayama
Kyoto University

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