Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Analysis of the biaxial stretching of Tetra-PEG gel TAKUYA KATASHIMA, UNG-IL CHUNG, TAKAMASA SAKAI, School of Engineering, The University of Tokyo, KENJI URAYAMA, Department of Materials Chemistry, Kyoto University — Non-linear stress-strain relationships that elastomers exhibit are governed by the strain energy density function (W). Although many types of W models were examined, full understanding of W still remains incomplete due to the two problems; the limitation in deformation range and the inhomogeneities in polymer networks. In this study, we perform various types of biaxial stretching for Tetra-PEG gels, which is a near-ideal network. We found that (1) the Neo Hookean (NH) model, which has been considered as a model for ideal networks, fails to describe the biaxial date; (2) the stress ratio σ_y / σ_x (where x and y are the stretching and constrained directions, respectively) in pure shear is larger than the expectation of the models with no strain-coupling term, and σ_y / σ_x increases with an increase in polymer fraction. These results indicate that the two effects, i.e., finite extensibility and strain-coupling should be introduced in W. We extend the Gent model, which considers the finite extensibility on the basis of the NH model, by adding a linear I_2 term. This model successfully describes the whole data with all fractions.

Takuya Katashima
School of Engineering, The University of Tokyo

Date submitted: 05 Nov 2012 Electronic form version 1.4