ADVANCED FUNCTIONAL MATERIALS

Supporting Information

for *Adv. Funct. Mater.*, DOI: 10.1002/adfm.201101438

The Interesting Influence of Nanosprings on the Viscoelasticity of Elastomeric Polymer Materials: Simulation and Experiment

*Jun Liu, Yong-Lai Lu, Ming Tian, Fen Li, Jianxiang Shen, Yangyang Gao, and Liqun Zhang **

Supporting Information

The Interesting Adjusting of "Nanospring" on the Viscoelasticity of Elastomeric Polymer Materials: Simulation and Experiment

Jun Liu[2], Yong-Lai Lu[1, 2], Ming Tian[1, 2], Fen Li[2], Jianxiang Shen[2], Yangyang Gao[2], Liqun Zhang[1, 2*]

[2]Key Laboratory of Beijing City on Preparation and Processing of Novel Polymer

Materials and [1]State Key Laboratory of Organic-Inorganic Composites, Beijing University of Chemical Technology, Beijing 100029, People's Republic of China.

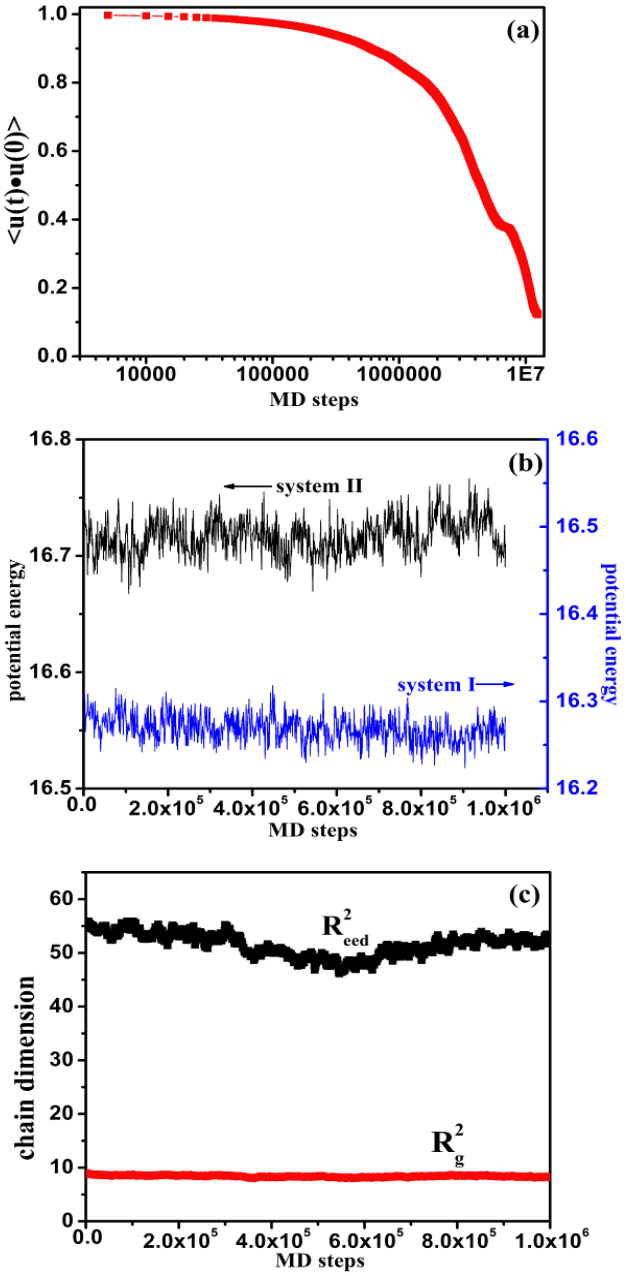

Figure S1: Before cross-linking (a) the decay of the end-to-end vector $< u(t) \cdot u(0) >$ of system I as a function of MD steps; after 1.5×10^7 MD steps of equilibration (b) the change of the potential energy of system I and II and (c) the variation of the mean square end-to-end distance R^2_{eed} and radius of gyration R^2_g of system I.

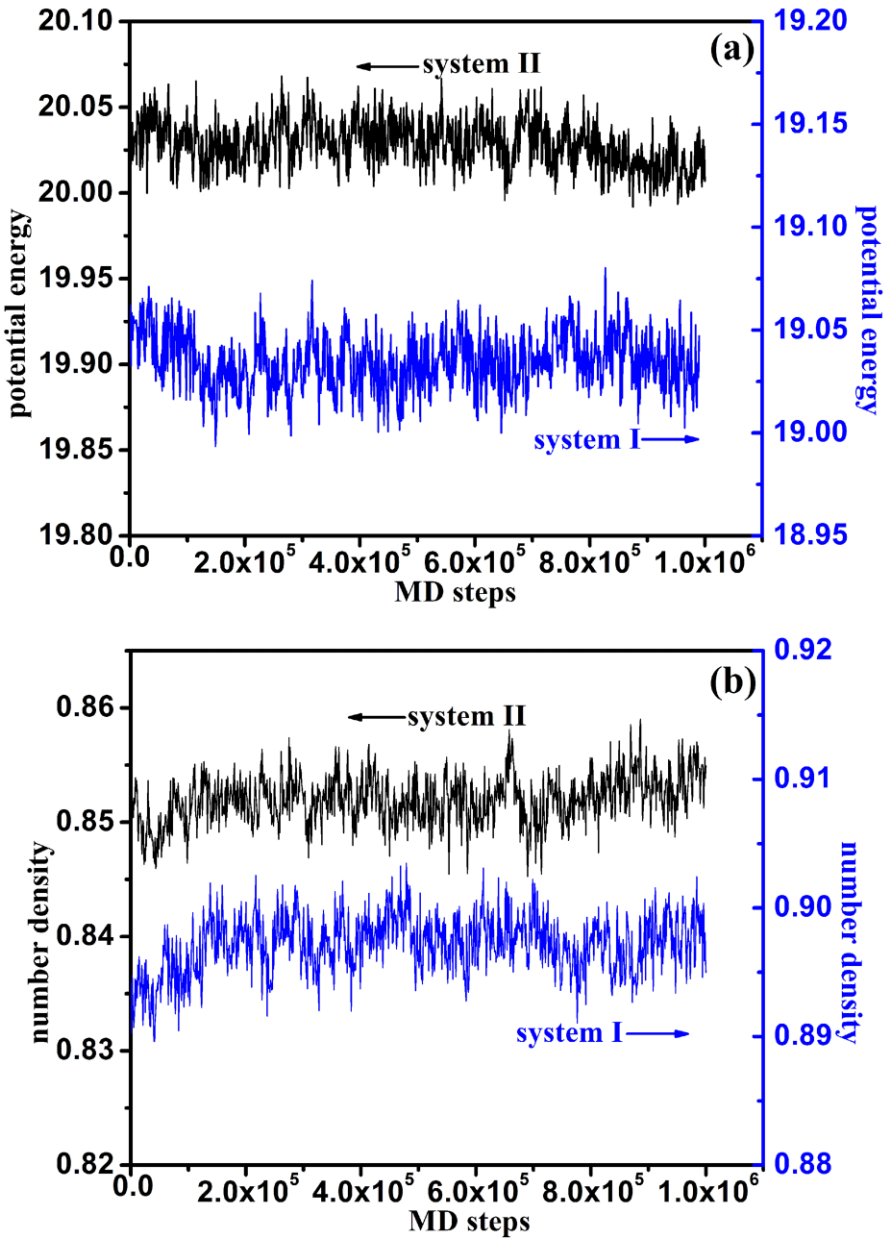

Figure S2: After cross-linking (a) the change of the potential energy and (b) the variation of the number density of beads for both systems I and II.

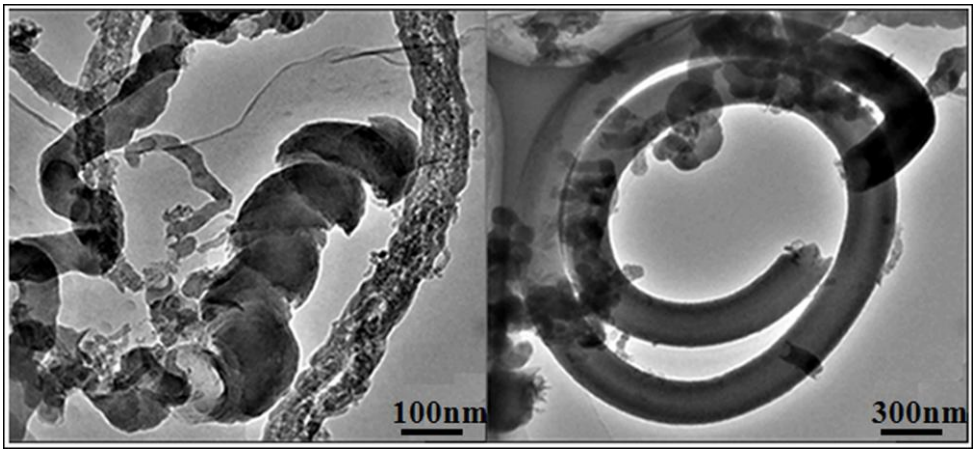

Figure S3: The TEM observation of carbon nanosprings, it is noted that in order for clear observation we have used carbon nanosprings with large diameter and aspect ratio.

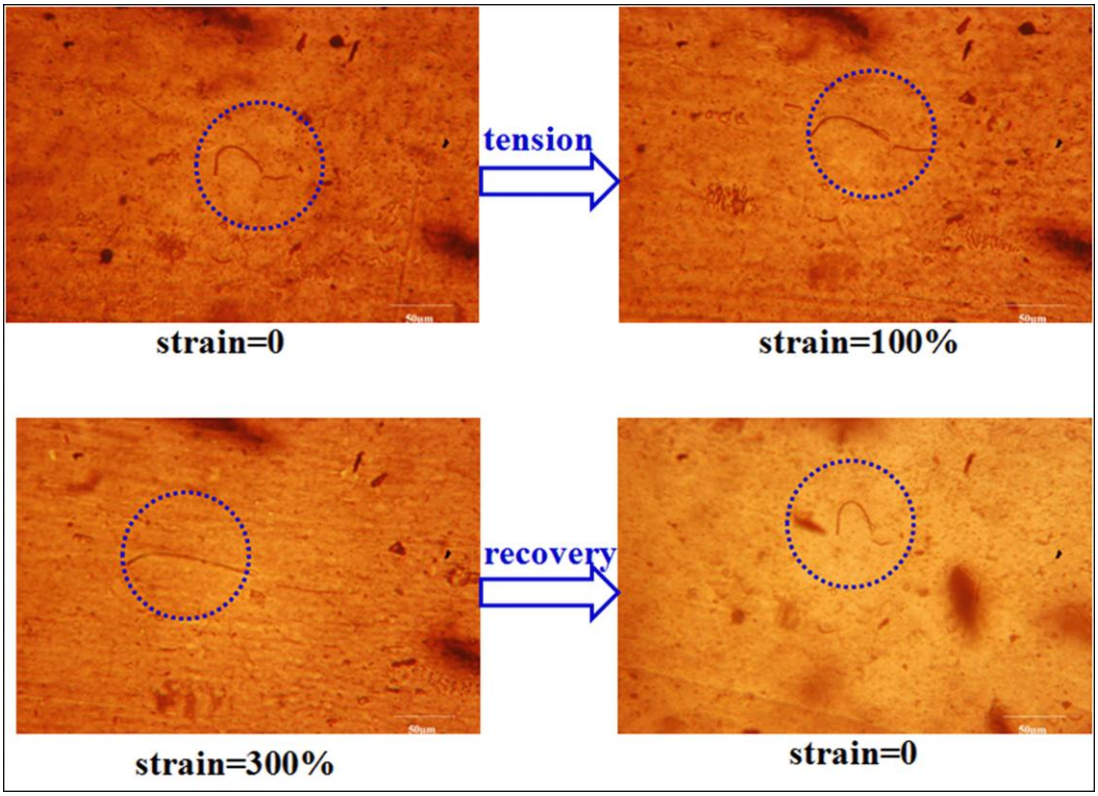

Figure S4: The microscopic deformation of the carbon nanosprings in the elastomer matrix during the tension and recovery process**.**

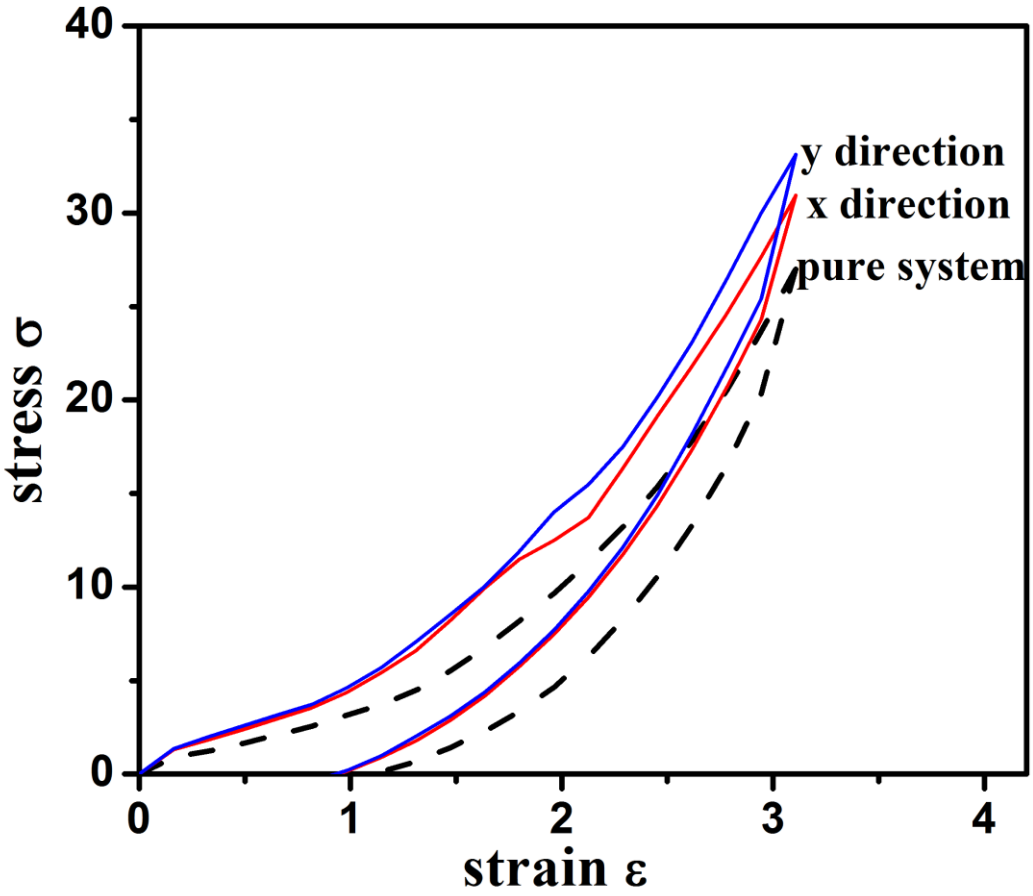

Figure S5: For nanosprings filled cross-linked polymer system (system I) without interfacial coupling, comparison between tension-recovery curves in the x and y directions. For clarity the stress-strain in the z direction is not shown, but almost the same as those in the x and y directions. For better comparison, the pure system is as well added. The volume fraction of the nanosprings is $\phi = 14\%$ and the spring constant is $K^* = K/\varepsilon = 500$.

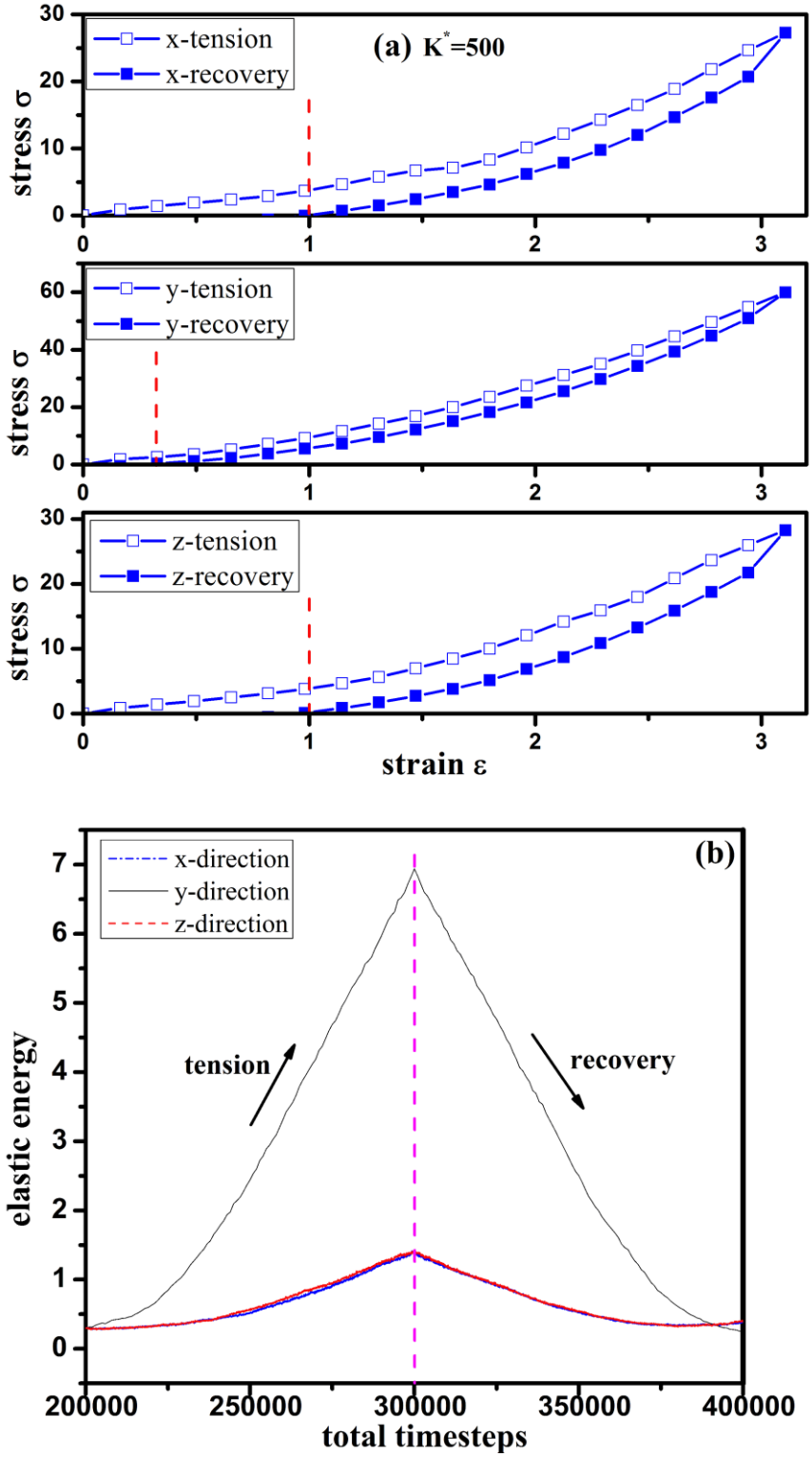

Figure S6: For nanosprings filled cross-linked polymer system (system II) and for the spring constant $K^* = 500$, (a) comparison of tension-recovery curves in the x, y and z directions; (b) the change of the elastic energy during the tension and recovery process. The volume fraction of the nanosprings $\phi = 14\%$, and the dimensionless spring constant $K^* = K/\varepsilon$.

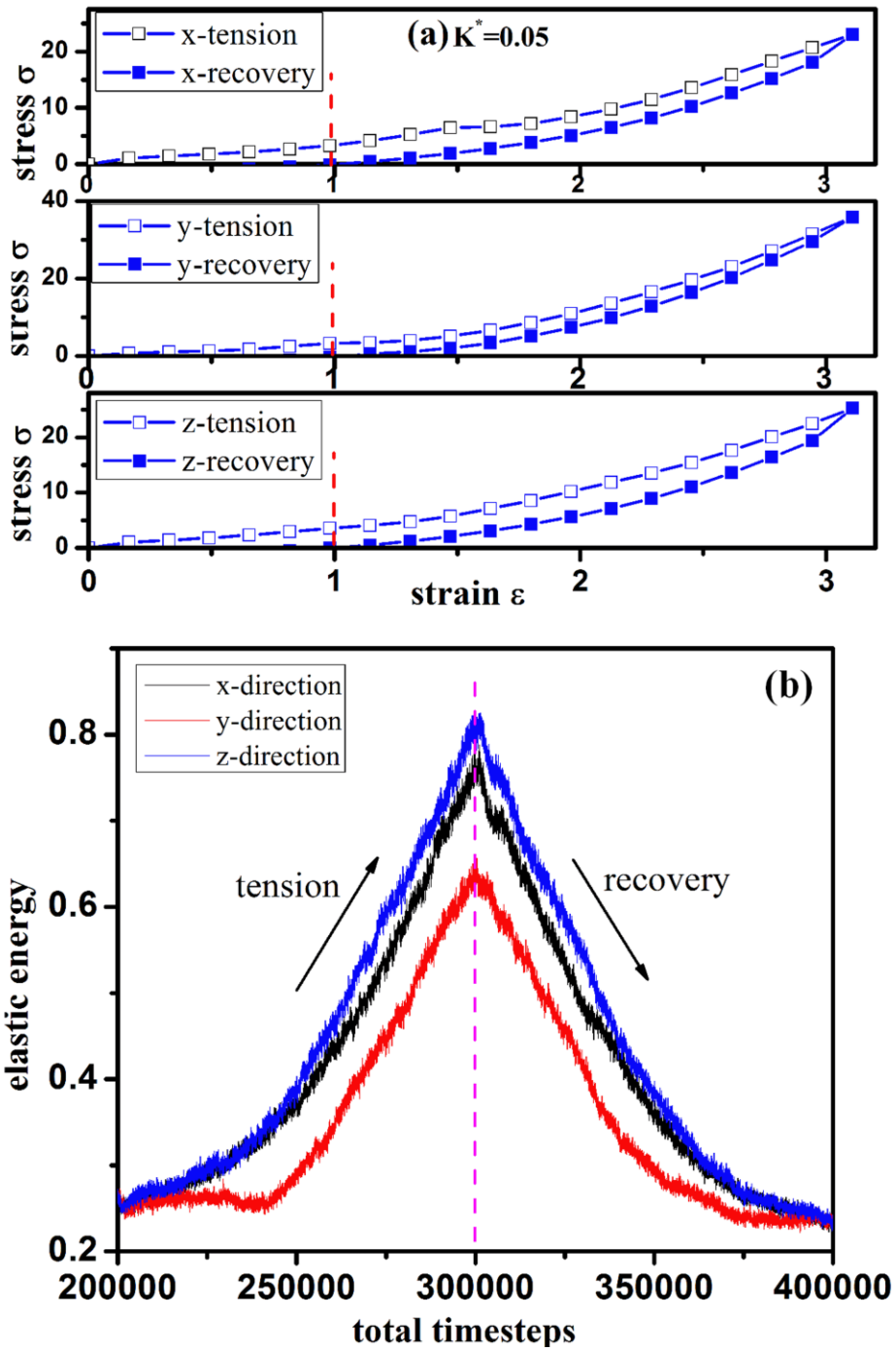

Figure S7: For nanosprings filled cross-linked polymer system (system II) and for the spring constant $K^* = 0.05$, (a) comparison of the tension-recovery curves in the x, y and z directions. (b) the change of the elastic energy during the tension and recovery process. The volume fraction of the nanosprings $\phi = 14\%$, and the dimensionless spring constant $K^* = K/\varepsilon$.