

Abstract Submitted  
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**Charge Effects on Mechanical Properties of Elastomeric Proteins** RAVI KAPPIYOOR, Department of Engineering Science and Mechanics, Virginia Tech, Blacksburg, VA 24061, USA, GANESH BALASUBRAMANIAN, Eduard-Zintl-Institute für Anorganische und Physikalische Chemie, Technische Universität Darmstadt, 64287 Darmstadt, Germany, DANIEL DUDEK, ISHWAR PURI, Department of Engineering Science and Mechanics, Virginia Tech, Blacksburg, VA 24061, USA — Several biological molecules of nanoscale dimensions, such as elastin and resilin, are capable of performing diverse tasks with minimal energy loss. These molecules are efficient in that the ratio of energy output to energy consumed is very close to unity. This is in stark contrast to some of the best synthetic materials that have been created. For example, it is known that resilin found in dragonflies has a hysteresis loss of only 0.8% of the energy input while the best synthetic rubber made to date, polybutadiene, has a loss of roughly 20%. We simulate tensile tests of naturally occurring motifs found in resilin (a highly hydrophilic protein), as well as similar simulations found in reduced-polarity counterparts (i.e. the same motif with the charge on each individual atom set to half the natural value, the same motif with the charge on each individual atom set to zero, and a motif in which all the polar amino acids have been replaced with nonpolar amino acids). The results show a strong correlation between charge and extensibility. In order to further understand the effect of properties such as charge on the system, we will run simulations of elastomeric proteins such as resilin in different solvents.

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