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Effects of the uniaxial elongation of a polymer/CNT fiber on its electrical properties HYUN WOO CHO, BONG JUNE SUNG, Department of chemistry, Sogang University, Seoul 139-701, Republic of Korea — We elucidate the effects of the uniaxial elongation of a polymer/CNT fiber on its electrical properties. Polymer fibers containing conductive nanofillers (such as carbon nanotubes (CNTs), and silver nanoparticles) have been utilized extensively for fabricating various forms of stretchable electronics including artificial muscles or electric conductive fabric. The electric conductivity of the polymer fiber usually decreases when it is stretched along the fiber axis, which would limit the scope of application. In addition, the reason and mechanism of decrease in the electrical conductivity remain elusive. In this work, we employ a coarse-grained model for the polymer/CNT fiber, and obtain the configurations of the fiber with respect to the strain via dynamic Monte Carlo (MC) simulations. Using global tunneling network (GTN) model, we calculate the electric conductivity as a function of strain. We find that the electric conductivity decreases during the elongation of the polymer/CNT fiber as was in experiments. We also find from tunneling network diagrams and critical path approximation (CPA) that the topological structure of the electrical network of the CNTs changes collectively during the elongation, which is responsible for the reduction of the electrical conductivity.

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