STRETCHABLE AND WEARABLE STRAIN SENSORS USING SUPER-ALIGNED CARBON NANOTUBE (SACNT) FILMS

ABSTRACT

Alexander K. Guo
International School of Beijing

Due to an increasing need for devices that are able to be stretched or bended while maintaining functionality, stretchable electronics have attracted much attention in recent years. Conventional rigid materials usually do not meet requirements of such high functionality. The purpose of this project is to use a new material - super-aligned carbon nanotube (SACNT) films to make stretchable and wearable strain sensors and demonstrate the potential applications for developing human-friendly devices.

In this study, I have found that the SACNT films possess super flexibility along the direction perpendicular to the axial direction, while most people have studied the electrical and thermal properties of carbon nanotubes on the axial direction. These carbon nanotubes are able to detect strain from a measured change in resistance, and can be stretched and worn due to its flexible properties at a macroscopic scale. The experimental results indicated that such SACNT strain sensors are capable of measuring strains up to 380% (76 times as much as conventional metal strain gauges), with high durability, fast response, low creep, and a super linear relationship between strain and resistance. I have made two devices using the SACNT sensors – a data glove and a simulated step counter that can detect various forms of motion. The data glove is light, simple, and able to sense any range of motion of the hand. This device might be used as a master-hand to control a remote slave robot, and perform tasks that humans cannot perform. Through this study, I have demonstrated the functionality of the new material and created human-friendly devices with abilities that are infeasible by a mere extension of conventional technology.