Water-resistant Single Walled Carbon Nanotube (SWCNT) based Stretchable Strain Sensor

Preety Ahuja, Sanjeev Kumar Ujjain, Radovan Kukobat, Katsumi Kaneko

Center for Energy and Environmental Science, Shinshu University, Nagano, Japan

Email:drpreetyahuja@gmail.com

With the advancement in wearable electronics, stretchable and electrically conducting materials in strain sensors become quite critical for diverse applications including e-skins, human motion sensors and heath monitors. These materials mainly include composites of elastomers and nanomaterials as stretchable matrix and sensing element respectively. Outstanding electrical and mechanical properties of fabricated strain sensors facilitates the application of single walled carbon nanotubes (SWCNT) as functional sensing element. Although these strain sensors are suitable to provide large sensitivity but they offer restricted measurement range and linear response in that range. Also, the sensing ability is limited under harsh environments say underwater detection. Hence, the development of water-resistive and reliable strain sensor with linear response is still the challenge for practical strain sensors.

We report SWCNT film embedded polydimethylsiloxane (PDMS) strain sensor, encapsulated in environmental benign water-resistive coating. The uniformly dispersed SWCNT in PDMS with Zn-Al dispersant facilitates the stretchable SWCNT networks to provide excellent linear response in large strain range (100%). The continuous usage of the senor enhances the performance due to the formation of stabilized SWCNT stacks, aiding reproducible and reliable cycling response. Excitingly, the water resistant coating work efficiently even under elastic deformations with no considerable change in contact angle in whole strain range of 100%, endowing a potential strain sensor for real time monitoring.