NW-P009

Metallized Electrospun Nanofiber webs with Bulckled Configuration for Highly Transparent and Stretchable Conductors

Yusung Jin[1], Sunju Hwang[2], Soo-Hwan Jeong[2]

[1]Pohang University of Science and Technology (POSTECH), 77 Cheongam-Ro, Nam-Gu, Pohang, gyeongbuk 790-784, Republic of Korea, [2]Department of Chemical Engineering, Kyungpook National University (KNU), 80 Daehak-Ro, Buk-Gu, Daegu 702-701, Republic of Korea

Transparent and stretchable conductors are expected to be an essential component in future stretchable optoelectronic devices. Until now, two main methods have been commonly employed to fabricate transparent and stretchable conductors by using metal nanomaterials: creating buckling configurations and creating network configurations. In this report, a novel strategy for obtaining transparent and stretchable conductors is presented, one that employs these two main approaches simultaneously.To the best of our knowledge, this proposed configuration of a buckled long nanofiber network in this study has not yet been reported. In order to provide the transparent conductors with dual mode stretchability originating from simultaneous buckled and network configurations, a buckled Au@polyvinylpyrrolidone (PVP) nanofiber network (hereafter referred to BANN for convenience) was fabricated by transferring Au-metallized electrospun PVP nanofibers onto a prestrained polydimethylsiloxane (PDMS) substrate. Our BANN shows considerably lower strain sensitivity of resistance than that of straight Au@PVP nanofiber network. Durability tests conducted by performing cyclic tensile strain reveal that the relative change in resistance of BANN (prestrain = 20%) is quite small after 1000 cycles. We also demonstrate that this BANN exhibits superior performance over widely used indium tin oxide conductors with regard to high optical transmittance and low sheet resistance.

Keywords: stretchable conductors, buckled nanofibers, nanofiber networks, electrospinning, transparent conductor

NW-P010

Highly Stretchable and Sensitive Strain Sensors Fabricated by Coating Nylon Textile with Single Walled Carbon Nanotubes

Da-Seul Park[1], Yoonyoung kim[1], Soo-Hwan Jeong[1]

[1]Department of Chemical Engineering, Kyungpook National University (KNU), 80 Daehak-Ro, Buk-Gu, Daegu 702-701, Republic of Korea

Stretchable strain sensors are becoming essential in diverse future applications, such as human motion detection, soft robotics, and various biomedical devices. One of the well-known approaches for fabricating stretchable strain sensors is to embed conductive nanomaterials such as metal nanowires/nanoparticles, graphene, conducting polymer and carbon nanotubes (CNTs) within an elastomeric substrate. Among various conducting nanomaterials, CNTs have been considered as important and promising candidate materials for stretchable strain sensors owing to their high electrical conductivity and excellent mechanical properties. In the past decades, CNT-based strain sensors with high stretchability or sensitivity have been developed. However, CNT-based strain sensors which show both high stretchability and sensitivity have not been reported. Herein, highly stretchable and sensitive strain sensors were fabricated by integrating single-walled carbon nanotubes (SWNTs) and nylon textiles via vacuum-assisted spray-layer-by-layer process. Our strain sensors had high sensitivity with 100 % tensile strain (gauge factor ~ 100). Cyclic tests confirmed that our strain sensors showed very robust and reliable characteristic. Moreover, our SWNTs-based strain sensors were easily and successfully integrated on human finger and knee to detect bending and walking motion. Our approach presented here might be route to preparing highly stretchable and sensitive strain sensors with providing new opportunity to realize practical wearable devices.

Keywords: stretcable strain sensor, carbon nanotubes, textiles, spray-layer-by-layer process