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Resistive strain sensors based on carbon black and multi-wall carbon nanotube composites
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Abstract
Strain sensors have garnered considerable interest, particularly in human motion and health monitoring, owing to their high stretchability and sensitivity. In this paper, resistive strain sensors comprising carbon black (CB)/Ecoflex and multi-wall carbon nanotube (MWCNT)/Ecoflex with high sensitivity and large mechanical strain are presented. These sensors were developed using solution casting and dip-coating techniques. In addition, toluene and acetone were used to enhance the adhesion of CB and MWCNT to the Ecoflex substrate, thereby increasing electrical conductivity, sensitivity, and flexibility of the sensors while maintaining their high stretchability. Toluene-treated strain sensors exhibited the highest sensitivity for both CB/Ecoflex and MWCNT/Ecoflex strain sensors. As a result, the CB/Ecoflex sensor with toluene treatment achieved the highest gauge factor (GF) of ~1131, which is 19 times higher than the original samples without surface treatment. Meanwhile, a GF of ~106 is exhibited by the MWCNT/Ecoflex sensor, with toluene treatment improving sensitivity by a factor of 2 over untreated samples. These promising findings demonstrate the potential and prospects for flexible and wearable sensor applications.

Author Keywords
Carbon black; Ecoflex; Gauge factor; Multi-wall carbon nanotube; Strain sensors

Index Keywords
Acetone, Carbon black, Gages, Multiwalled carbon nanotubes (MWCN), Surface treatment; Carbon nanotubes composites, EcoFLEX, Gage factors, Health monitoring, High sensitivity, Human health, Human motions, Multi-wall carbon nanotube, Resistive strain, Strain sensors; Toluene

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