PDMS-embedded SWCNT towards Fabrication of Stretchable Strain Sensor

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Advancements in nanotechnology is generating prospects for the fabrication of new generation thin film sensors that can be used for disease diagnosis and health monitoring [1]. In particular, wearable sensors can be mounted on the textile or on human skin by adhesive tapes or straps. The conventional sensing materials include metals, metal oxides, conductive elastomeric composite and silicon nanowires. Generally, metal or metal oxide sensors detect small stretching deformation whereas others can be used to detect large strain but linearity decreases at large strain range. Still, the pursuit of reliable strain sensor with features of high stretchability, sensitivity with linearity continues.

This study focuses on the development of a fully integrated (embedded) strain sensor that is fabricated on flexible substrate (PDMS) for potential use in sensing. The piezoresistive response of SWCNT composite from SWCNT inks with the aid of Zn/Al complex dispersant of SWCNT bundles[2] gives accurate strain measurement with ultra-soft PDMS matrix providing high flexibility and ductility for large strain range (Gauge factor of ~10.4 with linear response till 100% strain). The working principle is based on the change in electrical resistance by opening/closing of micro cracks generated under mechanical deformations as observed by in situ Raman measurements. Fabricated stretchable strain sensor shows large sensitivity and durable sensing performances during tensile strains. We demonstrate the application of our strain sensor (real time monitoring) with high sensitivity, drift characteristics and response speed.

References

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