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Multilayer nanocomposite based stretchable physical sensors

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The importance of human motion motoring is rapidly rising in many industrial sectors - entertainment (gaming, movie, etc.), healthcare (patient tracking, rehabilitation training, etc.) and sports (athlete evaluation, personal training, etc.). Here, we introduce two different types of nanocomposite-based highly stretchable and sensitive strain sensors that can be used for human motion monitoring. 1) Ag nanowire (AgNW) based stretchable strain sensor: The AgNW network-elastomer nanocomposite based strain sensors show strong piezoresistivity with tunable gauge factors in the ranges of 2 to 14 and a high stretchability up to 70%. The response of the sensors can be predicted very well by computational model based on the resistive network of AgNWs within the PDMS medium. We have found that the sandwich structured strain sensors have a good response to the bending and joint angle measurement. Smart glove system composed of multiple strain sensors and their application to control of avatar in virtual environment were demonstrated. 2) Carbon nanotube (CNT) based ultra-stretchable strain sensor: Super-stretchable, skin-mountable and ultra-soft strain sensors are presented by using carbon nanotube percolation network-silicone rubber nanocomposite thin films. The applicability of the strain sensors in epidermal electronic systems, in which mechanical compliance like human skin and high stretchability (ε>100%) are required, has been explored. We found that carbon nanotubes-silicone rubber based strain sensors possess super-stretchability and high reliability for strains as large as 500%. Nanocomposite thin films exhibit high robustness and excellent resistance-strain dependency for over ~1400% of mechanical strain. We have used this device for the real-time measurement of large strain developed on human skin during human motion.

Biography

Inkyu Park received PhD (mechanical engineering) at UC Berkeley in 2007. He received a BS and MS degrees (mechanical engineering) from KAIST in 1998 and UIUC in 2003, respectively. He worked as a research specialist at Berkeley Sensor and Actuator Center (BSAC) in 2007-08 and a visiting researcher at Hewlett Packard Lab in 2005-08. He is currently an Associate Professor in the department of mechanical engineering at KAIST. He is an expert in the nanofabrication, sensing devices & systems and mechanical reliability of micro/nano systems. He has published more than 100 articles in international journals and conferences. He also received several awards including Hewlett Packard (HP) Open Innovation Research Award in 2009-2012 and Best Paper Award in IEEE NANO 2010 Conference.

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