Docket #: S11-468

Process of Depositing Stretchable, Elastic, Transparent, and Conductive Carbon Nanotube Films on Silicone Substrates

Researchers from Stanford University have developed a novel method for generating stretchable, transparent, and conductive films. The creation of the film is a simple two step process. After spraying single-walled carbon nanotubes on a silicon substrate, the substrate can be stretched in different directions, thus causing the nanotubes to conform to a spring-like structure. Once this process is completed, these flexible films can accommodate strains of up to 150 percent and demonstrate conductivities of over 1000 Siemens/centimeter. This is the highest conductivity reported in the literature for a conductor that can be stretched over 100 percent. There are extensive pressure-sensing applications for this invention; it can be used as electronic skins for prosthetic limbs and on interactive displays.

Chemical Engineering postdoctoral fellow Darren Lipomi demonstrates the stretchable, artificial skin in the lab.

NPR "All Tech Considered" Feature
"Just Like Human Skin, This Plastic Sheet Can Sense And Heal", April 11, 2016

Applications

- Human-interactive, electronic skin for prosthetic limbs and artificial intelligence systems
- Solar modules that have curved surfaces
- Sensors

    - Pressure/Touch Sensors for Interactive Displays
    - Mechanical Sensors for biomedical devices

Advantages

- Simple
    - Two-step process to create film
        - Spray-deposited with a commercial airbrush
        - One-time application of Strain-and-release to the substrate
- Transparent
- Flexible and Conductive
    - Film able to accommodate strains of up to 150 percent and demonstrates a conductivity of 1000 Siemens/centimeter
        - Highest conductivity reported in literature for a conductor that can be stretched more than 100 percent
- Fracture-resistant

Publications

- Lipomi, Darren, Michael Vosgueritchian, Benjamin Tee, Sondra Hellstrom , Jennifer Lee, Courtney Fox, and Zhenan Bao, Skin-like Pressure and Strain Sensors based on Transparent Elastic Films of Carbon Nanotubes , *Nature Nanotechnology*, 6, pp. 788–792, Published online 23 October 2011: 1-5, DOI:10.1038/nnano.2011.184
- Bergeron, Louis, Stanford Researchers Build Transparent, Super-stretchy Skin-like Sensor, Stanford University News Service, published online 24 October 2011.
- Fyffe, Steven, "Nanotube Springs Stretch Skin-Like Sensor", Uploaded by Stanford University on 21 October 2011.

Patents

- Published Application: 20140109695
- Issued: 9,212,960 (USA)

Innovators

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