Stretchy materials as electrical conductors

Technology #5557

Neurosynthetic implants and stretchable electronics require highly conductive materials that are elastic. Macroscale stretching of solid materials cause elongation and bending of chemical bonds that are needed for the transport of electrons along orbitals, causing a reduction in electrical conductivity. Liquid metals have high electrical conductivities and can flow, but cannot be stretched because they are held only by weak interatomic bonds. Current solutions to stretchable electronics involve incorporating nano-conductors such as carbon nanotubes and nanowires into elastic polymers. These methods suffer from issues such as low conductivity and loss of elasticity with high carbon nanotube loading.

Advanced nano-materials for flexible electronics

Gold nanoparticles offer an attractive solution to carbon nanotubes and nanowires with high aspect ratio. They offer greater matrix mobility and hence greater overall elasticity than entangled CNTs and nanowires. When stretched, nanoparticles could take a different configuration that will still facilitate electron transport. Researchers state that conductivities as high as 11000 Scm⁻¹ and 2400 Scm⁻¹ were obtained for quiescent and deformed (110% strain) samples respectively. These materials could provide the pathway to producing a new generation of flexible electronic devices.

Applications

- Flexible electronics
- Neurosynthetic implants
- Flexible, lightweight solar cells and batteries
- E-paper and e-textiles
- Conductive membranes

Advantages

- Flexible, lightweight
- Highly conductive even when stretched

Inventors

Nicholas Kotov