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Smart Fabric – Microelectronic Properties of Textiles Coated with Carbon Nanotubes

Can fabric be used like a computer and/or protect sensitive electronic equipment? The purpose of this investigation was to determine if the application of a carbon nanotube (CNT) bioplastic film could impart useful microelectronic properties to a treated textile. I hypothesized that coating cotton fabric with a carbon nanotube-starch composite would enhance electrical conductance, electromagnetic interference, and static interference, with a magnitude of effect inversely related to nanotube size. This experiment involved test samples created from the combination of plasticized starch and carbon nanotubes of different sizes. Each sample was then applied as a finish to cotton fabric using the dip-dry method and then tested for electrical conductance, electromagnetic interference, and static interference. Compared to an untreated control, each of the finished fabric samples demonstrated electrical conductance with a ten-fold greater mean conductance for smaller CNT (10-20 nm) than larger CNT (50-80 nm). Treated textiles shielded an electromagnetic field with a magnitude of effect over five times greater for smaller CNT than larger CNT. Also, compared to the control, each fabric test sample exhibited static interference, but the relative magnitude of effect could not be determined due to the measurement being qualitative rather than quantitative. These findings lead me to believe that a fabric coating resulting from the combination of plasticized starch and carbon nanotubes can be engineered to confer microelectronic properties to textiles, with size-based efficiency. Applications of this technology include digital static protection, bio-sensing, and avionics- including use in military uniforms and equipment.