

Single-walled carbon nanotubes: from synthesis to applications

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The unique properties of single-walled carbon nanotube (SWNT) films, such as high porosity and specific surface area, low density, high ratio of optical transmittance to sheet resistance, high thermal conductivity and chemical sensitivity, and tunable metallic and semiconducting properties, open up avenues for a wide range of applications.

Direct integration of the CNTs produced by the aerosol methods into different applications, especially for high-performance flexible and stretchable electronics, is discussed. Produced SWCNT/polyethylene composite films have exhibited excellent optical and electrical properties as well as high mechanical flexibility. It was found that the electrical conductivity of the SWCNT films could be significantly improved by ethanol densification and chemical doping. SWCNT/polyethylene thin films demonstrated excellent cold electron field emission properties. We have fabricated state-of-the-art key components from the same single component multifunctional SWNT material for several high-impact application areas: high efficiency nanoparticle filters, transparent and conductive electrodes, electrochemical sensors with extremely low detection limit, and polymer-free saturable absorbers for ultrafast femtosecond lasers.

In addition, wide application potential of these networks is demonstrated by fabricating SWNTs produced by this method were successfully applied to field effect transistors, sensors, supercapacitors, and heterojunction and dye-sensitized solar cells.