

Carbon Nanotube-based materials for energy and the environment

Christopher T. Kingston

Nanotechnology holds the potential to reshape almost every aspect of modern human life; including transportation, electronics and communications, sports and leisure, medicine and health, energy and the environment. These changes will be both evolutionary, where nanomaterials are used to improve upon currently existing technologies, as well as revolutionary in which new technologies are developed that would not otherwise be possible. At the heart of this transformation are numerous nanoscale materials, such as nanoparticles, quantum dots, nanowires, fullerenes, graphene and nanotubes, that display remarkable properties that can differ greatly from their molecular and bulk-scale counterparts and which give rise to the almost limitless number of prospective applications. Carbon nanotubes (CNT) are one of these key building blocks and could potentially play one of the largest roles in changing our technological landscape. CNT have the most extraordinary electrical, mechanical, physical and chemical properties ever exhibited by a single material. They are by far the strongest and stiffest materials ever known, conduct electricity better than copper, and are the best conductors of heat. Additionally, they have rich photophysical properties, are chemically resilient and are non-toxic in biological systems when properly treated. Harnessing these properties in tangible ways, though very challenging, will have far-reaching benefits, particularly with respect to sustainable energy issues:

- Lighter, stronger fibers, textiles and composites — lower weight and higher performance vehicles and aircraft; less fuel consumption
- Higher electrically and thermally conductive materials — lower energy consumption; higher efficiency energy delivery networks
- Transparent conductors — high-efficiency photovoltaic devices and electronic displays
- Faster & more efficient electronics — lower energy consumption

In this presentation I will give an overview of current research efforts within the National Research Council Canada and around the world to use carbon nanotubes to address global energy and environmental concerns.