

Introduction for JEP Special Issue on Carbon Nanotubes

Since the first identification of carbon nanotubes in 1991, more than 60,000 research papers have been published (with around 3500 papers just published in 2009), reporting findings on electrical, thermal, and mechanical properties and manufacturing methods as well as functionalization of this material. More than 23,000 of these papers were mainly addressing the electrical properties of the carbon nanotubes and proposed applications in the electronics and energy fields.

Carbon nanotubes gained this huge interest due to the large variation in their dimensions as they can range from few nanometers long to few centimeters long, and their diameters can range from just one nanometer for a single-walled carbon nanotube to 60 nanometers for multiwalled carbon nanotubes and even higher for ropes of carbon nanotubes. Another very attractive property of carbon nanotubes that encouraged a lot of researchers and electronics manufacturers to study them is the variety in their electrical properties from metallic (or semimetallic) to semiconductors with different band gap that can be controlled by the chirality of the carbon nanotubes.

The electronics industry is looking for ways to implement the next generation manufacturing technique (the down-top technique) to build the nanoelectronics as using the classical top-down techniques is getting more difficult. Because at these nanoscale dimensions, the current manufacturing technology has reached its limit. Carbon nanotubes are the first candidates to replace traditional metals and alloys not only for their suitability as building blocks in the down-top manufacturing technique but also due to their high current carrying capacity and their insensitivity to electromigration and their high mechanical strength and high thermal dissipation capability.

This year's special issue of the ASME journal of electronic packaging was allocated for carbon nanotubes, because of their novel nanoscale properties which attracted very high interest. The issue is composed of contributions from the top national and international researchers in the field of carbon nanotubes and their use. The articles in the issue cover a variety of topics including experimental and analytical studies of carbon nanotubes thermal interfaces, mechanical study of the unraveling of carbon nanotubes due to field emission using molecular dynamics simulations, the study of the role of heterogeneous network of semiconducting and metallic tubes and its effect on electrical, thermal, and optical behaviors, and experimental and analytical study of the use of carbon nanotubes as fillers for thermal interface materials for electronic packaging.

We express our sincere gratitude to all the contributors of this special issue and the Editor in Chief for working with us on this issue tirelessly.

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