Abstract

Carbon nanotubes and nanofibres are promising materials for many different applications. Their interesting electrical, thermal and mechanical properties have been attracting attention for their use in electronic circuits, thermal handling and as components in composites.

One method of producing carbon nanotubes is plasma-enhanced chemical vapour deposition (PE-CVD). This method allows control of length and position of vertically aligned carbon nanofibres (VACNFs), as well as the growth of forests of aligned multi-walled carbon nanotubes (MWCNTs). We have investigated PE-CVD growth of both VACNFs and MWCNT to elucidate what parameters are important in the control of the growth and to optimise the growth conditions. Optical emission spectroscopy was used to monitor the plasma composition *in situ*. It was found that the growth of CNTs and CNFs was strongly affected by the amount of atomic hydrogen in the plasma. Laser reflection was also used for *in situ* monitoring of the growth speed and the deposition of amorphous carbon on top of the MWCNT forests.

Investigations of some applications of the grown tubes and fibres are also presented. Emission spectroscopy was used to investigate light emission from carbon nanotubes used as electron field emitters. We also examined the possibility of using carbon nanotubes in microfluidic coolers. VACNFs embedded in a polystyrene membrane showed promising results as an anisotropic electric conductor.

Keywords: Carbon nanotubes, vertically aligned carbon nanofibres, plasma-enhanced CVD, optical emission spectroscopy.