

Executive summary

The Technology Watch report "CARBON NANOTUBES: APPLICATIONS" has been made by the Circle of Innovation in Materials, Aerospace Technology and Nanotechnology (CIMTAN) at the request of a group of investigators from the UNED interested in creating a technology based company. For the elaboration of this report the CIMTAN has received advice and collaboration from experts in the UNED and the University of Valladolid.

The objective of the report is to reflect the great variety of applications where carbon nanotubes can be used. The report consists of two complementary parts: the report in paper and an attached CD which includes the own report and several annexes with complementary information which can be accessed using hyperlinks from the main text.

The information shown in the report has been extracted from specialized Data Bases, which have been searched using concrete sentences adapted to the subject. The content of the report has been organized in the following way: first, concepts are classified and developed; second, the results are analyzed according to different criteria (by content, year, country, etc.); and, finally, a small summary and some conclusions are included.

The report shows how carbon nanotubes are the raw material for the development of a great number of applications, mainly the following ones: electronics, sensors, scientific instrumentation, photonics, materials, biotechnology and chemistry, energy and mechanics. In **electronics**, flat screens which use carbon nanotubes as field emitters are the most developed application at present. In the area of **sensors**, specially chemical and biological ones will profit a lot from carbon nanotubes properties. In **scientific instrumentation**, scanning probe microscopes will improve their performance thanks to the use of carbon nanotubes as probe ends. In **photonics**, carbon nanotubes will lead to the improvement of some devices but also to the development of new ones which will make it possible to separate photonics and electronics. The new compound **materials** containing carbon nanotubes are very important because of their wonderful mechanical, electrical, optical, etc. properties. In the field of **biotechnology and chemistry**, medicine is the main application, where carbon nanotubes can be used for different objectives, being drug delivery the most promising one; medicines carried inside carbon nanotubes will be delivered at the exact point where they are needed, increasing this way the effectiveness of the medicine and reducing secondary effects. In **energy** fuel cells can benefit from the use of carbon nanotubes, but also hydrogen storage, supercapacitors, lithium batteries and solar cells. Finally in **mechanics** the report shows the importance of NEMS (NanoElectroMechanical Systems), small electromechanical devices with nanometric dimensions that are mainly used as sensors and actuators, where carbon nanotubes can act as cantilevers, oscillators, engines, tweezers, etc.