ELECTRIC CONDUCTIVITY OF SILVER NANOPARTICLE DOPED CARBON NANOFIBRES MEASURED BY CURRENT-SENSITIVE ATOMIC FORCE MICROSCOPY

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ABSTRACT

In this work, a pioneer study on the electrical properties of composite carbon nanofibres (CNFs) using current-sensitive atomic force microscopy (CS-AFM) have been demonstrated. CNFs are highly interesting materials usable in a wide array of application e.g. electrode material for biosensors, lithium ion batteries, fuel cells and supercapacitors. CNFs offer high specific surface and thus have a high contact area for charge transfer. CNFs can be produced using a spinnable polyacrylonitrile (PAN) as a precursor for carbonisation. For the purpose of developing efficient CNFs with high conductivity and power density, silver nanoparticles (AgNPs)-containing PAN solutions were electrospun to form composite nanofibres followed by heat treatment. The applied voltage of the spinning setup and the content of both PAN and silver nanoparticles in the spinning solution were varied in order to study their influence on the morphology and the electrical properties of the nanofibres. The resultant morphologies and fibre diameters were determined by scanning electron microscope (SEM). The formation of silver nanoparticles was characterised in solution by UV-visible absorption spectroscopy and dynamic light scattering (DLS), while energy-dispersive X-ray spectroscopy (EDX) and transmission electron microscopy (TEM) were carried out to investigate the presence as well as the average diameter of the AgNPs. The electrical properties of CNFs was performed using CS-AFM. This technique gives us the possibility to explore the electrical properties of a single fibers and hence derive relations between the the structural features and the electrical properties. Our results show that the composite CNFs have a higher electrical conductivity than the neat CNFs and both the average diameter of the fibers and electrical conductivity increase with increasing AgNPs content.