MECHANICAL PROPERTIES OF POLYANILINE/CARBON NANOTUBE COMPOSITES

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Carbon nanotubes (CNTs) have outstanding mechanical, electrical and thermal properties [1]. Especially their large elastic modulus and breaking strength make them highly attractive for their use as reinforcement in nanocomposite materials [2, 3, 4]. Here, composites based on conducting polymers (CPs) and CNTs are promising for the development of new classes of multi-functional advanced materials. Among the known CPs, polyaniline (PANI) has a high potential due to its easy of synthesis, excellent environmental and thermal stability and reversible control of its electrical properties.

In this work PANI/MWNTs composites containing different nanotube content were synthesized by an "in-situ" polymerization process, i.e. by chemical polymerization of aniline in the presence of MWNTs.

Composite materials were characterized by electron microscopy, infrared spectroscopy, conductivity, thermogravimetric, mechanical and elemental analysis. The results show that the MWNTs are covered with PANI, stabilization is achieved by π-π interaction between both components leading to higher thermal stability and an increase in conductivity by 9 orders of magnitude is observed. Like pure EB, composites are completely soluble in N-Methyl-pyrrrolidinone, maintaining processing possibilities of PANI. Consequently free-standing films of the composites were successfully obtained making feasible further characterization by Dynamic Mechanical Thermal Analysis (DMTA). It is remarkable that DMTA reveals that an increase of storage modulus by a factor of 4 can be achieved with only 1wt% of MWNTs. The presence of MWNTs also affects the interaction between PANI and the remaining solvent in the films, leading to an increase of PANI glass transition temperature.

References:

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