

# **Development of a Carbon Matrix Nano-composite Reinforced with Carbon Nanotubes**

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## **Abstract**

A nano-composite was developed by incorporating multi-walled carbon nanotubes (MWCNTs) as a nano-scale reinforcement into the pure mesophase pitch. Two different routes were used to produce the composite, i.e. (i) using a solvent to disperse the carbon nanotubes in mesophase pitch and (ii) dry mixing of mesophase pitch powder and carbon nanotubes (CNTs) without a solvent. In the first process, dispersion of CNTs (~1.5 wt %) was performed in a solvent whereas Propan-02-01 and water were used as solvents. The mesophase pitch was also mixed with the same solvent. Both solutions were mixed slowly and gradually and stirred on a magnetic stirrer for about 18 hours. In the second method, the carbon nanotubes (1% by weight) were ground manually and then mixed with mesophase pitch without a solvent. After that the material was put in the electric blender for a long time for a good mixing. The spinning rig was used to spin the filaments/ribbons from the dispersion containing MWCNTs. The resulting nano-composite filaments/ribbons produced by route (i) were in reasonably good condition although breakage was observed during the spinning process. The composite material prepared by dry mixing of pitch powder and carbon nanotubes showed better results, i.e. continuous filaments/ribbons. This research therefore proves that a nano-composite material can be developed with nanotubes as reinforcing fibers in a mesophase pitch matrix. The microstructure of resulting composite ribbons was studied by Scanning Electron Microscopy (SEM) and optical microscopy. These micrographs clearly show the presence of nanotubes within the mesophase pitch matrix. The microstructure reveals that these ribbons have random texture whereas the carbon tapes obtained from pure mesophase pitch had a flat-layer texture of graphene layers. These images also show that CNTs affect the morphology of nano-composite filaments and hence the properties of these ribbons could be different from those obtained from pure mesophase pitch.

Keywords: Carbon matrix micro-composite, Multi-walled carbon nanotubes, Mesophase pitch, Scanning Electron Microscopy (SEM), Optical Microscopy