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ΘΕΜΑ: **Investigation of the orientation in composite fibers of polycarbonate with multiwalled carbon nanotubes by RAMAN microscopy**

ΤΟΠΟΣ: Αίθουσα Σεμιναρίων ΙΤΕ/ΕΙΧΗΜΥΘ

ΗΜΕΡΟΜΗΝΙΑ: Παρασκευή, 23 Σεπτεμβρίου 2005

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ΠΕΡΙΛΗΨΗ

The global market for chemical fibres is steadily increasing, so the demanding on new industrial fibres with special or improved properties emerge. Such special fibres with improved mechanical properties and electrical conductivity are requested for applications as reinforcement fibres (e. g. for smart clothes), electromagnetic shields or armors. For fibres with diameters ranging between 10 and 100 microns only nanoscaled fillers can be used. The superior association of their inherent good mechanical and electrical properties makes carbon nanotubes outstandingly interesting for making such fibres. We prepared composites of polycarbonate (PC) with multiwalled carbon nanotubes (MWNT) by melt mixing in an extruder using the masterbatch dilution technique /1/. The conductive PC composite containing 2 wt% MWNT and the pure PC were melt spun using a piston type spinning device. Different take-up velocities up to 800m/min and different mass throughputs were used. Raman spectroscopy was applied in order to get information on the MWNT orientation, alignment, and crystallinity. For interpretation, the peak of the G band at 1609 cm-1 which is assigned to the in-plane vibrations of the graphitic wall and the peak of the D band at 1284 cm-1 originating from disorder in the graphitic structure were used. The alignment of the nanotubes along the fibre axis was investigated using polarized Raman microscopy regarding the D and G bands of the MWNT. As you can see by TEM, the curved shape of the nanotubes still exists in the melt spun fibres. At higher take-up speed, the MWNT started to align by reducing their curvature. Polarized Raman microscopy indicated that the D/D and G/G ratios parallel/perpendicular to the fibre axis increase for both bands in a similar manner with the take-up velocity. This can be explained with an improved orientation and alignment of the MWNT in the fibre axis induced by high shear forces and fast fiber solidification during melt spinning. The intensity ratio D/G was used to assess the degree of crystallinity. A lower ratio indicates a higher crystallinity. The D/G ratios were calculated and compared between the polarization direction parallel and perpendicular to the fiber axis. These D/G ratios were nearly independent on the draw speed. That means that this ratio is more or less independent on the MWNT orientation and alignment. Thus, we can conclude that the crystal structure of the MWNT is not changed by composite melt spinning.