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CARBON-NANOTUBE-REINFORCED POLYMERS

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Using carbon nanotubes (CNTs) as nanoscale devices is expected to be one way of exploiting the physical properties. The manufacture of carbon-nanotube-reinforced polymer composites on the other hand will lead to an increasing range of possible applications. These nanocomposites will not only be a step forward in high-strength, lightweight materials but also the highly novel electronic nature and thermal properties of the CNTs can be used.

Our aim is to develop these carbon-nanotube-reinforced polymers. The first project step is the evaluation of CNT materials from different manufacturing processes such as laser ablation, arc discharge, chemical vapour deposition, and catalytic growth processes with regard to their structure and yield for applications in nanocomposites.

The nanocomposites are obtained by introducing the SWCNT into the reaction mixture whilst the synthesis of PBT. The polymer without carbon nanotubes (reference material) and with carbon nanotubes were synthesised using an in situ polycondensation reaction process. The nanotubes are dispersed in 1,4-butanediol (BD) by ultrasonication and by ultrahigh speed stirring. The nanocomposites were extruded followed by injection moulding. The samples were characterised by thermal analysis, electron microscopy, dynamic-mechanical analysis, and tensile testing.

The addition of only a small amount of CNT was enough to improve the thermo-mechanical properties of the nanocomposites. The Young`s modulus, tensile strength, and strain monotonically increased with increasing amount of CNT in the PBT matrix. However, when the content of CNT was increased from 0.1 wt. % to 0.2 wt. %, the strength and the strain of the nanocomposites decreased.

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