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INFLUENCE OF BALL MILLING ON THE PROPERTIES OF MULTIWALLED CARBON NANOTUBES AND THEIR COMPOSITES WITH POLYCARBONATE

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Ball milling of carbon nanotubes (CNT) is a common way to produce tailored CNT material for composite applications. In order to assess the influence of the ball milling procedure of NanocylTM NC7000 nanotube material the length distribution before and after milling for 5 and 10 hours was quantified using transmission electron microscopy (TEM). In addition, the agglomerate size in the powders, the dispersability in aqueous surfactant dispersions using centrifugal separation analysis, and the morphologies using RAMAN and XPS were investigated. With increasing ball milling time a significant nanotube shortening, a decrease of agglomerate size, and an increase of packing density took place and a worse dispersability was observed. In the XPS study a higher [O]:[C] ratio was found for the ball milled nanotubes indicating the formation of oxygen group on the nanotubes surface. In melt mixed CNT-polycarbonate (PC) composites the electrical properties, the nanotubes length distribution after processing, the nanodispersion of nanotubes and the macrodispersion of residual CNT agglomerates using TEM or light microscopy were studied. The changed properties of the ball milled nanotubes are reflected in the properties of the PC composites. The slight increase in the electrical percolation threshold in the melt mixed composites with ball milling time of CNT can be assigned to lower aspect ratios as well as the worse dispersability of the ball milled nanotubes. In addition, a decrease of CNT aspect ratio during the melt compounding took place and could be quantified. The authors thank Nanocyl S.A. (Sambreville, Belgium) for providing the CNTs.