

TRIBO-MECHANICAL CHARACTERIZATION OF REINFORCED MWNT/PMMA COMPOSITES.

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This work reports tribo/mechanical investigations of multiwall carbon nanotube reinforced polymethylmethacrylate MWNT/PMMA. The composites were produced following a recently reported coagulation method of the PMMA in the presence of water. In this method, a saturated solution of PMMA and a controlled wt% of MWNTs in Dimethylformamide (DMF) is immersed in water, precipitated and filtered. The final product in the form of small grains is the hot pressed and formed for testing.

Dispersion of the MWNTs in the matrix were analysed by Transmission Electron Microscopy (TEM). Mechanical properties were monitored by stress – strain curves of specifically formed test pieces. Moreover, surface universal hardness and wear behaviour were characterised by ultramicro-indentation, Scratch Tests and pin-on-disc respectively. The observed results show that both, the universal hardness (HU) and the elastic modulus (E') of the MWNT/PMMA composites increase as the concentration of the additive increases. It is shown that for additive concentrations of only 5 wt%, the universal hardness increases by a factor 1.5 with respect to the pristine PMMA (Figure 1). Mechanical properties of Composites reveal a good correlation between the elastic modulus (micro-indentation) and the elastic to plastic transition critical loads as observed by scratch tests (Figures 1 and 2).

Contact sliding tests, as carried out by pin-on-disc evidence the influence of the additives in the wear properties of the composites. The incorporation of the MWNTs in the PMMA matrix above 2wt% improves the wear resistance of the composites. Wear mechanisms arose from fatigue occurring during the sliding process, as due to repetition of elastic deformations of the composite surface below their respective yield strength limits. The same effect was previously observed for polyvinyl-alcohol (PVA) reinforced with MWNTs.

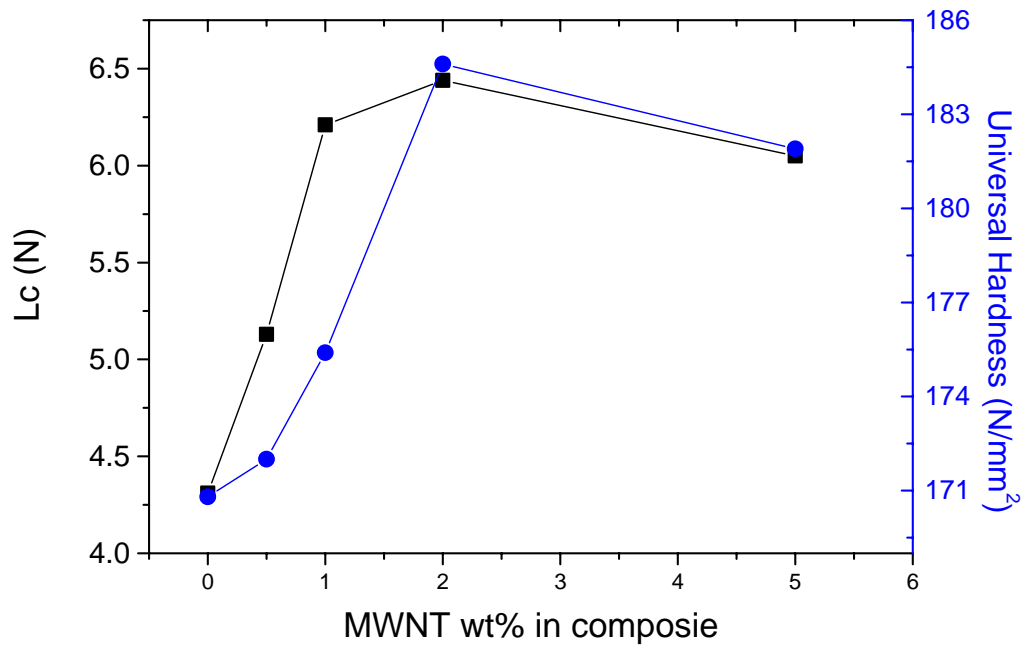


Figure 1. Universal hardness and critical load for plastic deformation of PMMA composites as a function of wt% of MWNTs.

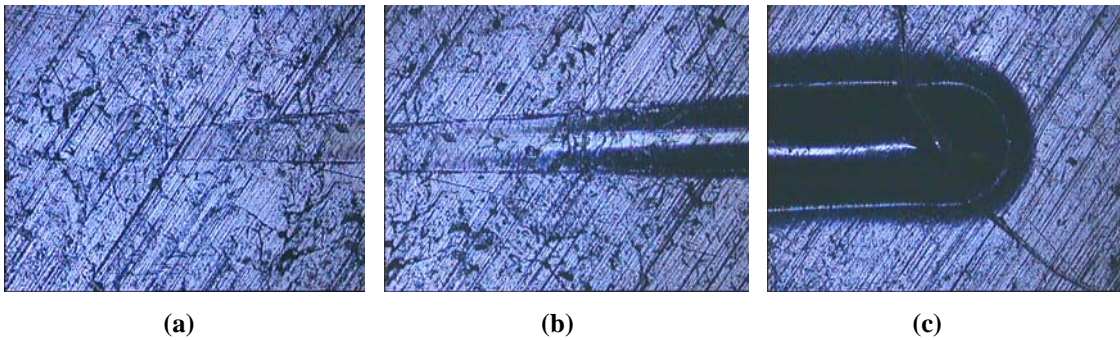


Figure 2. Scratch tracks on 5wt% CNTs loaded PMMA. (a) start of scratch, (b) elastic-plastic transition at Lc 6.2 N. End of scratch track at 20N.