# Strain sensing in polymer/carbon nanotube composites by electrical resistance measurement

M. Mičušík*, K. Czaniková, J. Kuliček, M. Omastová

*Polymer Institute, Slovak Academy of Sciences, Dúbravska cesta 9, 845 41 Bratislava 45, Slovakia*

G. Georgousis, P. Georgiopoulos, E. Kontou

*Mechanics Department, National Technical University of Athens, Iroon Polytechniou 9, Zografou 15780, Athens, Greece*

P. Pissis, A. Kyritsis, C. Pandis

*Physics Department, National Technical University of Athens, Iroon Polytechniou 9, Zografou 15780, Athens, Greece*

In this work multiwall carbon nanotubes (MWCNTs) dispersed in a polymer matrix have been used for strain sensing of the resulting nanocomposite under tensile loading. This was achieved by measuring the relative electrical resistance change (DR/R0) in conductive polyvinylidenefluoride (PVDF)/MWCNTs nanocomposites prepared by melt-mixing with varying filler content from 0.5 wt.% to 8 wt.%. Two main parameters were systematically studied. The PVDF/MWCNTs mixing procedure that results in a successful MWCNTs dispersion, and the effect of MWCNTs content on material' s sensing behaviour. The ac conductivity measurements clearly show that the transition from the insulating to the conducting phase, the so-called percolation threshold ($p_c$), is observed between 1 and 1.25 wt.% MWCNTs (Fig. 1), followed by a sharp increase in conductivity of about six orders of magnitude ($p_c$ = 1.2 ± 0.1 wt % ).The samples were subjected to tensile loading and the longitudinal strain was monitored together with the longitudinal electrical resistance. The results showed that MWCNTs dispersed in insulating PVDF matrix have the potential to be used as a sensitive network to monitor the strain levels in polymer/carbon nanotube nanocomposites as the deformation level of each sample was being reflected by the resistance changes [1].

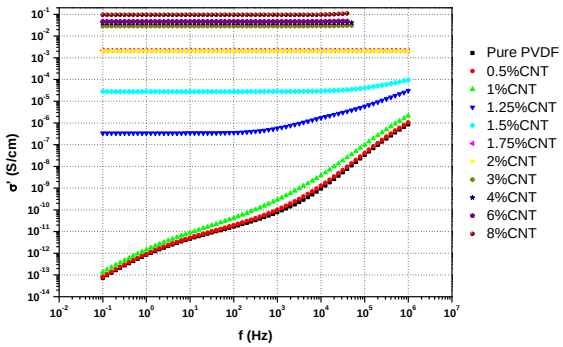


Figure 1: Real part of conductivity σ´ against frequency.

## References

[1] G. Georgouis, C. Pandis, A. Kalamiotis, P. Georgiopoulos, A. Kyritsis, E. Kontou, P. Pissis, M. Mičušík, K. Czaniková, J. Kuliček, M. Omastová. Composites Part B: Engineering, **68**, 162 (2015).

* matej.micusik@savba.sk