

# **Polymer reinforcement with SiO<sub>2</sub>/MgO** coated multiwall carbon nanotubes

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#### Introduction

Multiwall carbon nanotubes (MWCNTs) have excellent mechanical, electrical, magnetic properties and a high aspect ratio, which make them an ideal reinforcing agent for high strength polymer composites. Complete coverage of the surface with an inorganic material may help to reduce the aggregation of MWCNTs and overcome consequent dispersability problems. Polymer filler materials - talc or dolomit - are often used in the industry to improve mechanical properties. The surface treatment improves the interaction between the polymer matrix and the MWCNT.

In this work MWCNTs were coated with talc-like oxides to facilite their incorporation into polymer matrix. Silica – magnesia mixed oxid were synthesized from different silica and magnesia precursors. As prepared samples were characterized by TEM, SEM, EDX, Raman and XRD techniques. In order to investigate the change of the polymers' properties these samples were also implicated into PA, PE, PP matrix. Tensil properties of MWCNT/polymer composites were measured by tensile test and dynamic mechanical analysis (DMA).

#### Synthesis of coated multiwall carbon nanotubes

#### • 0 - 5wt% MWCNT

- Mg:Si :  $H_2O$  3:4:4 (I) and 3:4:8 (II) Molar ratio:
- sodium metasilicate pentahydrate  $Na_2SiO_3 \times 5 H_2O$ • Precursors: magnesium nitrate hexahydrate:  $Mg(NO_3)_2 \times 6 H_2O$

#### • Preparation method: impregnation

4h, 400°C • Annealing:

## **Properties of SiO<sub>2</sub>-MgO/MWCNT nanocomposites**

#### **Preparation of MWCNT/polymer composites**

#### Internal laboratory mixer (Brabender type)

- Rotor speed: 40 1/min
- 180°C (PP, PE), 230°C (PA) Temperature:
- Measured torque: 4,5 Nm
- Composition: **50g polymer matrix**, 0,5g **MWCNT**

## **Properties of SiO<sub>2</sub>-MgO/MWCNT polymer composites**



































PP II.5

## Conclusion

- Multiwall carbon nanotube was succesfully coated with SiO<sub>2</sub> MgO nanoparticles
- XRD and Raman analysis confirmed the presence of mixed oxide nanoparticles on the surface of MWCNTs
- Raman investigation confirmed the presence of the MWCNTs in the polymer matrices
- In case of PE covered multiwall carbon nanotubes increased the Young's modulus of the polymer
- **Covered multiwall carbon nanotubes increased the transition glass temperature of the polyamide matrix**





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