



## NOVEL HYBRID COMPOSITES FROM HIGH DENSITY POLYETHYLENE REINFORCED BY NANOCCLAY-FILLED POLYAMIDE 6 FIBRILS

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### Keywords

PA6, nanoclay, MFC, WAXS

### Abstract

Polyamide 6 filled with nanosized, montmorillonite (o-MMT/PA6) is nowadays one of the most common polymer nanocomposites with plate-like reinforcement in industrial applications. This work reports on the preparation and characterization of a new type of hybrid composite materials as an attempt to avoid the disadvantages of o-MMT/PA6 and MFCs.

### Introduction

In the first part of this work, PA6 masterbatches containing 10 or 20 wt. % MMT were diluted with neat PA6 through twin-screw extrusion obtaining exfoliated composites with MMT content in the 1.0-7.5% range. These o-MMT/PA6 composites were characterized by DSC, TGA, mechanical tests, and synchrotron X-ray scattering in wide and small angles (WAXS, SAXS), FT-IR microscopy.

In the second part of this work, the PA6 containing charges of MMT was mixed with the respective amounts of HDPE by melt extrusion to obtain blends with 10 or 20 wt. % of PA6 nanocomposite, the latter containing up to 7.5% MMT. MFCs without and with 2.5 wt. % of compatibilizer were prepared into thin plates.

### Results and discussion

For the PA6/MMT composites significant increase of the modulus was observed with the increase of the nanoclay. High thermal resistance and increase of the T<sub>g</sub> again according to the clay load was also noticed.

Synchrotron studies, mainly WAXS helped us to see the level of crystallinity and the polymorphic structure. The ratio between the  $\alpha$  and  $\gamma$  form decreases with the increase of the clay load, with the presence of nanoclay. These polymorphic transitions are related to the changes in the mechanical properties.

For the second part of the work, MFC's production and characterization, with the increase of the clay load in the reinforcing PA6 phase, the modulus increases. The presence of compatibilizer increases the modulus additionally.

WAXS data software treatment reveals that the nanoclay is present both in the oriented and isotropic scattering, but the isotropic part does not contain PA6.

For additional analysis SEM imaging was applied to the ready MFCs. It revealed the physical size of the microfibrils and the influence of the compatibilizer.

### Acknowledgments

The authors gratefully acknowledge funding by FCT, Fundação para a Ciência e Tecnologia, under the reference PhD grant number SFRH/BD/30121/2006

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