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Hdpe/mesoporous silica nanocomposites by in-situ polymerisation: structural details and mechanical response

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Mesoporous silicas exhibit stable three-dimensional structures, made of ordered channels with well-defined geometries and dimensions at nanometer scale, able to host intercalation reactions.

Recently we report the use of mesoporous materials of the M41S class, that when combined to metallocene complexes create supported catalysts for olefin polymerisation and allow the synthesis of hybrid organic inorganic materials by *in-situ* polymerisation, within a large range of nanofiller concentrations. These HDPE/MCM-41 nanocomposite materials exhibit an improved mechanical performance and an easier degradability, because of the additional role of mesoporous MCM-41 as promoter for PE degradation [1,2]. Further attempts to enhance the mechanical performance of these materials involved the synthesis of several nanocomposites based on polyethylene, at a given MCM-41 content (about 10 wt. %), using different strategies for filler/polymer matrix modification in order to trigger an improvement at interfaces and, consequently, in the adhesion between the two components [3, 4].

Pursuing this aim here we report the synthesis of HDPE/MCM-41 nanocomposites with improved mechanical performance through a combined strategy that involves both the preparation of controlled morphology MCM-41 nanoparticles (Figure 1), and the use of adequate dispersants/interfacial agents (ex: amphiphilic polymers or modifying agents with organophilic character) and homogenization procedures.

The obtained nanocomposites were characterized from morphological and structural standpoints and the corresponding mechanical parameters evaluated. The performance of these materials is discussed in terms of their morphology, sample homogeneity and crystalline structure. By selection of adequate conditions, the formation of high dimension agglomerates can be reduced and the dispersion of the inorganic nanoparticles can be improved, which reflects positively in the corresponding mechanical performance of the resultant nanocomposite.

Fig 1 SEM micrograph of MCM-41 nanoparticles

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Acknowledgements:

Financial support of MICINN (projects MAT2007 65519-C02-01 and MAT2010-19883), Exchange Collaboration Program CSIC/FCT (projects 2009PT0026 and Proc. 441.000 CSIC 2010/2011, respectively), and Fundação para a Ciência e a Tecnologia (FCT) (Projecto PDCT/CTM/66408/2006).

Keywords: mesoporous silica, in-situ polymerisation, metallocene catalysts, polyethylene based nanocomposites