MCM-41 as Nanofiller in Polyethylene Hybrid Materials

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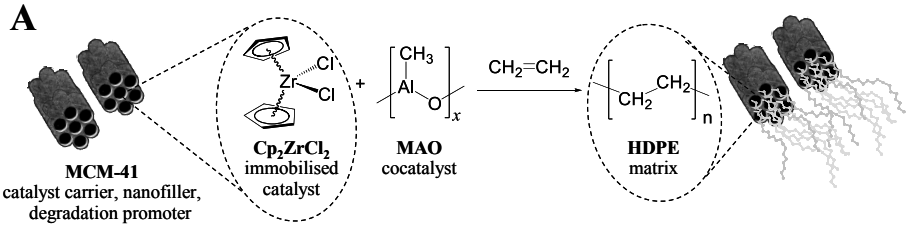
Mesoporous MCM-41 exhibits a stable framework structure, well-defined nanopores and a large surface area. When combined with metallocene polymerisation catalyst, these mesoporous materials, provide a unique route for preparing polyolefin-based nanocomposites by *in situ* polymerisation. Catalytic aspects of these polymerisations have been examined[1], but structure and properties of the nanocomposites are scarcely investigated. This work addresses the synthesis of polyethylene/MCM-41 nanocomposites through *in situ* polymerisation and several strategies are envisaged aiming to improve compatibility between the filler and the matrix. These strategies include: (**A**) polymerisation of ethylene using MCM-41 in the dual role of nanofiller and catalyst (Cp_2ZrCl_2) carrier; (**B**) copolymerisation of ethylene with a polar comonomer using MCM-41 in the role of nanofiller (**C**) polymerization of ethylene using modified MCM-41, as nanofiller.



Characterisation of the materials obtained with strategy (A) confirms that they are true nanocomposites, since the ethylene polymerisation has occurred at intrapores and MCM-41 exhibits a particle distribution on the resulting hybrid materials at the nanometric scale. A confinement effect is found and a delay in the crystallisation process of the macrochains within pores and channels is observed. The materials present also an important increase in rigidity. The comparison of mechanical response of the different nanocomposites, at fixed filler content, is assessed by microhardness (MH) measurements performed at the surface of films. The novel self-reinforced nanocomposites present a rigidity enlargement as well as an easier degradability because of the additional role of mesoporous MCM-41 as catalyst for PE degradation. Therefore, their use may lead to cheaper, lighter and more environmentally friendly materials.

[1] a) Campos, J. M.; Ribeiro, M. R.; Lourenco, J. P.; Fernandes, A. *J. Mol. Catal. A-Chem.* **2007**, 277, 93; b) Campos, J. M.; Lourenço J. P.; Fernandes, A.; Ribeiro, M. R. *Catalysis Communications* **2008**, 10, 71.