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INFLUENCE OF THE DISPERSION DEGREE ON THE MECHANICAL PROPERTIES OF POLYAMIDE 6 NANOCOMPOSITES FILMS

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The promising thermo-mechanical and barrier properties of polymer/clay nanocomposites have induced a high scientific interest and high industrial expectations, especially for packaging applications (e.g. films) for which improved usage performances associated with good optical properties are key issues. However, the achievement of polymer nanocomposites supposes to disperse the MMT platelets at the nanoscale (intercalation, exfoliation) and to avoid dispersion as micrometer-sized aggregates. The purpose of this work is to evaluate the influence of the clay platelets dispersion degree (quantitatively characterised) on the mechanical properties of polyamides 6 (PA6) nanocomposites films based on montmorillonite. Different montmorillonite (Cloisite 30B, 10A and Na+) were chosen to modulate the dispersion state. The dispersion degrees evaluated using TEM, rheology and NMR demonstrate that in the case of Cloisite 30B, a full exfoliation (98%) combined with excellent homogeneity is obtained. In the case of Cloisite 10A the exfoliation degree decreases (around 50%) and the Cloisite Na+ leads to a microcomposite. The evaluation of the the tensile properties of the different types of nanocomposites films demonstrate that a full exfoliation is needed to obtain higher improvement of the stiffness. However, even in the case of a well exfoliated nanocomposite a large decrease of the ductility is observed. Surprisingly, at low montmorillonite content the ductility of the microcomposite (based on Cloisite Na+) is higher compared to nancomposites. The deformation of the nanocomposites were studied using a video-extensometer, so as to understand the influence of the dispersion degree on the deformation mechanisms.