Carboxylate clays as a new route for polypropylene nanocomposites from sodium-Montmorillonite

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Polypropylene (PP)/clay nanocomposites are mainly prepared by melt-blending from alkylammonium-Montmorillonite (organoclay) and using compatibilizers like PP-graft-maleic anhydride (PP-g-MA). The main drawback of using organoclays is the thermal stability of the surfactant. Indeed, alkylammonium often degrades at extrusion temperatures leading to a silicate layers collapse which limits the clay dispersion and consequently the material properties. We report the preparation of carboxylate clays by intercalating carboxylate salts inside Sodium-Montmorillonite (NaMMT) interlayer. These carboxylate clays are interesting for the production of PP/clay nanocomposites. The carboxylate salts within the clay layers, are used to partially neutralize the PP-g-MA anhydride groups in situ during the melt compounding. The ionic groups of the partially neutralized PP-g-MA then offer favourable interactions with the clay hence reinforcing the interfacial junction between polymer and clay and improving the composite properties. The originality in this work is the preparation of innovative carboxylate clays and the study of their structural and thermal properties. Different carboxylate salts at different concentrations were intercalated into the silicate layers. The clay basal spacing was measured by X-ray diffraction (XRD) and the clay thermal stability by thermogravimetric analysis (TGA). The interactions between the clay and the carboxylate salts were investigated by infrared spectroscopy (FTIR). Finally, PP-g-MA/clay nanocomposites were synthesized from a carboxylate clay and compared with a reference nanocomposite from NaMMT. Nanocomposites were also produced from NaMMT by in situ synthesizing the carboxylate clays. The clay dispersion was examined by XRD and transmission electron microscopy. The neutralization of the PP-g-MA was determined from FTIR analysis and the nanocomposites were characterized by TGA and rheology. The use of carboxylate clays clearly improves the clay dispersion into the polymer matrix and rises the nanocomposites thermal and rheological properties.