



Preparation and characterization of kaolinite intercalated nanocomposites

J. P. Cosp¹, M. B. Guerrero¹, F. Corpas², R. Artiaga³, A. R. del Valle¹

1 Universidad de Malaga, Malaga, Spain. ramonartiaga@gmail.com;

jpascualc@uma.es 952 13 20 69

2 Universidad de Jaen, Linares, Spain.

3 Universidad de A Coruna, Ferrol, Spain.

Preparation of hybrid organic-inorganic materials by intercalation of organic molecules in kaolinite brings about the possibility of availability of new materials with special functionalities. Its intimately assembled structure may give them new unique properties, as a combination of the silicate and organic component ones. These modified nanoclays can be used in industrial applications such as chromatography columns, selective catalysts, catalyst supports, high performance sorbents, ion exchangers, membranes, optical and electrochemical mechanisms and enzyme and dye supports in polymer and composites. Some of these applications are not sufficiently exploited. Technical applicability of these materials is controlled by the reactivity in the intercalation, thermal stability and the quality of the final products.

Preparation, characterization and study of the thermal behavior of various kaolinite nanocomposite intercalates are covered in this work, making use of kaolinite-polypyrrole nanocomposites as an example. The kaolin used in this work comes from Poveda de la Sierra, in Guadalajara, Spain. Its kaolinite content is above 95%, with small amount of micas and quartz.

The composite kaolinite-polypyrrole is obtained by polymerization of pyrrole in a kaolinite-pyrrole

complex. Oxidant compounds as iron(III) chloride (FeCl_3), ferric sulfate ($\text{Fe}_2(\text{SO}_4)_3$) and ammonium persulfate ($(\text{NH}_4)_2\text{S}_2\text{O}_8$) are usually employed to accelerate the reaction. In this work, the polymerization was carried out without additives, at room temperature and pressure, under natural light. Although this way lasts more than when using accelerants, it allows for obtaining higher rates of intercalates.

It can be observed in Figure 1 that the spacing obtained at the 001 basal reflection was reduced to 11.40 Å in the polymer composite, while in the monomer complex it was 14.20 Å. It is due to the re-orientation of the pyrrole molecules produced by the polymerization at the inter-laminar spacing and to an important decrease of the inter-laminar species (I. A. I. = 70%). The main peak keeps the original symmetric and intense shape presented by the kaolinite-pyrrole complex. Equally spaced distribution and ordered stacking were also retained, with six diffractions attributed to the intercalated compound. Basal reflections of the kaolinite can also be observed, originated by the de-intercalated fraction produced by the polymerization process. Another consequence of the polymerization is an increase of the adsorbed reactant, which produces an increase of the diagram background. A difference with