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NEAR-INFRARED SPECTROSCOPY FOR ON-LINE MONITORING OF NANOCLAY DISPERSION IN POLYMER NANOCOMPOSITES

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Over the last decade polymer science and technology has found its focus on the nanocomposites research field. The possibility of enhanced properties, at low cost, allured all major industries working with plastic products.

At the end of the 1980s, a Toyota research group motivated the resumption of interest as they exposed a successful production, by *in-situ* polymerization, of a fully exfoliated nanocomposite, in which the silicate layers were individually dispersed in a nylon-6 matrix. Yet again, a renewed attention rose when the possibility of obtaining highly intercalated nanocomposites by melt-mixing was proven. Melt-mixing allows using conventional compounding equipment, thus being the main stream process for preparation of polymer based nanocomposites.

Even though a lot of research has been made in this area, the actual manufacture by melt-mixing process of these materials continues to face difficulties, particularly in terms of establishing clear correlations between processing conditions and final dispersion levels. With final properties being highly dependent on the morphology of the nanocomposite, the availability of fast response on-line techniques is of great practical interest.

In recent years, the developments in fibre optic probes gave an impulse in several innovative applications and with that Near-Infrared (NIR) spectroscopy became a powerful analytical tool. Even though NIR is routinely used in the polymer industry, its application to monitor on-line nanocomposites preparation is still limited.

The present work aims at applying NIR spectroscopy to on-line monitoring of the dispersion of an organoclay within a polymeric matrix. Nanocomposites based on polypropylene (PP) and organo-modified montmorillonite (O-MMT) were prepared in a co-rotating twin screw extruder under different conditions. The nanoclay dispersion at a given barrel position was monitored by NIR. Several off-line techniques were used as reference, to develop a robust chemometric model that enables the assessment of the nanoclay dispersion during processing.

Keywords: Near-infrared spectroscopy; layered silicates; nanocomposites; on-line monitoring