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# A combined experimental and theoretical approach to establish the relationship between shear force and clay platelet delamination in melt-processed polypropylene nanocomposites

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## Abstract

In this article, a combined experimental and theoretical approach has been proposed to establish a relationship between the required shear force and the degree of delamination of clay tactoids during the melt-processing of polymer nanocomposites. Polypropylene (PP) was selected as a model polymer, and nanocomposites of PP with organically modified clay were prepared by a master batch dilution technique in a twin-screw extruder. The effect of PP throughput during the dilution of the master batch on the dispersion and orientation of clay platelets were studied in detail. Powder X-ray diffraction, small and wide angle X-ray scattering and high resolution transmission electron microscopy were used to study the structure and morphology of the obtained nanocomposites. The results showed that a lower feeding rate led to the orientation of clay platelets almost in the direction of extrusion. The adhesive force and the interaction energy between the clay platelets were theoretically calculated using the Hamaker approach. The analysis showed that the peeling mechanism is a practical explanation for the delamination of clay platelets during melt extrusion and that the dimensions of the clay platelet tactoids play an important role in the peeling due to the shear stress.