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INFLUENCE OF TWIN-SCREW PROCESSING CONDITIONS ON STRUCTURE AND PROPERTIES OF POLYPROPYLENE - ORGANOCLAY NANOCOMPOSITES

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Melt processing is a commonly used method for producing thermoplastic based nanocomposites. Addition of nanofiller such as organomodified montmorillonite layered clay is mostly used to enhance tensile, impact and barrier properties of the neat matrix. Initial clay agglomerates need to be finely dispersed within the matrix during the process in order to form exfoliated nanostructures. Interactions between non polar thermoplastics such as polyolefins and organomodified clay are usually promoted by the presence of a compatibilizer. Maleic anhydride grafted polypropylene (PP-g-MA) is generally used in the case of polypropylene matrix. Besides the need to use a compatibilizer, a good state of dispersion and distribution of the clay requires optimized processing conditions.
Many studies have focused on the influence of nanocomposite formulations on their final properties, but few have paid attention to the nanostructure sensitivity to processing conditions. This study deals with the influence of extrusion parameters such as screw speed, feed rate and barrel temperature on the nanocomposite structure and its consequences on final properties. Nanocomposites of polypropylene, maleated polypropylene and organomodified montmorillonite with respective mass fraction of 85/10/5 were prepared with a ThermoFischer PTW24 co-rotating twin-screw extruder using a masterbatch dilution method. The structure of obtained nanocomposites was quantified by scanning and transmission electron microscopy (SEM, TEM), X-ray diffraction and dynamic rheometry. The level of exfoliation, related to the yield stress identified by rheometry, was related to extrusion parameters depending on the processing conditions.