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Study on effect of filler loading on the flow and swelling behaviors of polypropylene-kaolin composites using single-screw extruder

Abstract

Melt flow and extrudate swelling behavior of polypropylene-kaolin (PP-Kaolin) composites were investigated using a single-screw extruder. Kaolin was mixed with polypropylene (PP) using a heated two-roll mill at 185°C and the filler loading were varied from 5 to 30 wt %. Subsequently, flow behavior of the compounded formulations were evaluated through Melt Flow Index (MFI) measurement at various temperatures ranging from 190 to 230°C. The extrudate swelling ratio was also measured by using an image analysis instrument and software. It was proven that the MFI decreased with increasing loading of kaolin for test temperatures of 190 and 200°C. However, for temperatures exceeding 200°C, the MFI value rose slightly at 5 wt % of kaolin content then seemed to reduce as more kaolin was added. This is also detected in rheological measurement where the apparent visosity, ηapp, appear to be lowered at 5 wt % loading of kaolin. Further increase in kaolin loading resulted in increasing value of the composites ηapp. The swelling ratio decrease with increasing filler loading for composites below 20 wt %. However, at 30 wt % of kaolin content, the extrudate swelling ratio increased and noticeable blistered surface texture was observed on the extrudate surface. Furthermore, at this level of filler loading, shrinkage occurence due to the existence thermal gradient between the surface and the inner core of the extrudate caused void formation in the middle section of the extrudate..

Keywords — Composites, polyolefins, processing, rheology, swelling