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EFFECT OF BLENDING SEQUENCE ON THE RHEOLOGICAL AND MORPHOLOGICAL PROPERTIES OF HDPE/LLDPE BLEND-BASED NANOCOMPOSITES

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Nanocomposites based on a high density polyethylene (HDPE)/linear low density polyethylene (LLDPE) blend were prepared by melt-intercalation in a torque rheometer (Haake Rheomix 600p at 180°C and 80rpm) using an organo-montmorillonite (20A) as a nano-filler and maleic anhydride-grafted linear low density polyethylene (LLDPE-g-MA) as compatibilizer. The effect of five blending sequences on microstructure, crystallinity and rheological properties of the prepared samples were examined. Dynamic and steady shear measurements were carried out in a controlled stress rheometer at 180°C. The permanent rheological properties showed that the nanoclay's addition to the HDPE/LLDPE blend increased the shear viscosity at low shear rates, changing the behavior of HDPE/LLDPE matrix to a Bingham model behavior with an apparent yield stress. The blending sequence (LLDPE/LLDPE-g-MA/20A)/HDPE (called S3, where LLDPE and LLDPE-g-MA were first reinforced with organoclay and then this nanocomposite was later blended with HDPE) showed a lower slope of the viscosity versus shear rate curve, and these results can be an indication that the interactions between the matrix and the organoclay are stronger. The organoclay interlayer spacing and the crystallinity were also influenced by the blending sequence. The crystallinity was calculated through mathematical deconvolution of the peaks in WAXD profiles. Overall, the crystallization of HDPE in the blends was hardly influenced by the presence of LLDPE. S3 showed lower cristallinity when compared to others blending sequences. On the other hand, it was observed an increased in the organoclay interlayer spacing of this nanocomposite because the intercalation process occurs preferentially in the amorphous phase. TEM analysis showed that the degree of dispersion of organoclay aggregates in S3 was considerably higher than that in S2 (where LLDPE was mixed with LLDPE-g-MA and then the LLDPE/LLDPE-g-MA was blended with HDPE and organoclay later), since the nanocomposite added on S3 facilitated the dispersibility of 20A to a better degree.