POTENTIAL ROLE OF SILICA AND PCC NANOFILLERS AS COMPATIBILIZERS IN IMMISCIBLE PLA/LDPE BLENDS

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ABSTRACT

Carefully chosen commercial nanofillers: silica (SiO_2) and precipitated calcium carbonate ($CaCO_3$), were used as compatibilizers in immiscible polylactide/low-density polyethylene (PLA/LDPE) blend. The general aim of this paper is to investigate the possibilities of replacing the standard commercial plastics such as LDPE based on non-renewable mineral oil resources with the biodegradable renewable polymer PLA in compatibilized PLA/LDPE blends for the use in packaging industry.

The calculations of the minimal interfacial energy and optimal wetting abilities indicated SiO_2 filler as a better potential compatibilizer, than $CaCO_3$, for a given PLA/LDPE blend, due to its preferential localization at the interface. Commercial $CaCO_3$ nanofiller showed less efficacy which in PLA/LDPE blend caused the heterogeneous surface of failure with the sign of phase de-bonding followed by visible plastic deformations that lower the strength at break of incompatible systems, what is in correlation with the high interfacial energy and preferential filler localization in one of the phases (LDPE) and not at the interface. The decreased size of dispersed domain and fine morphology in PLA/LDPE/SiO_2 blend demonstrates that SiO_2 can improve the compatibility between PLA and LDPE phases, and as a consequence increase toughness and crystallinity.

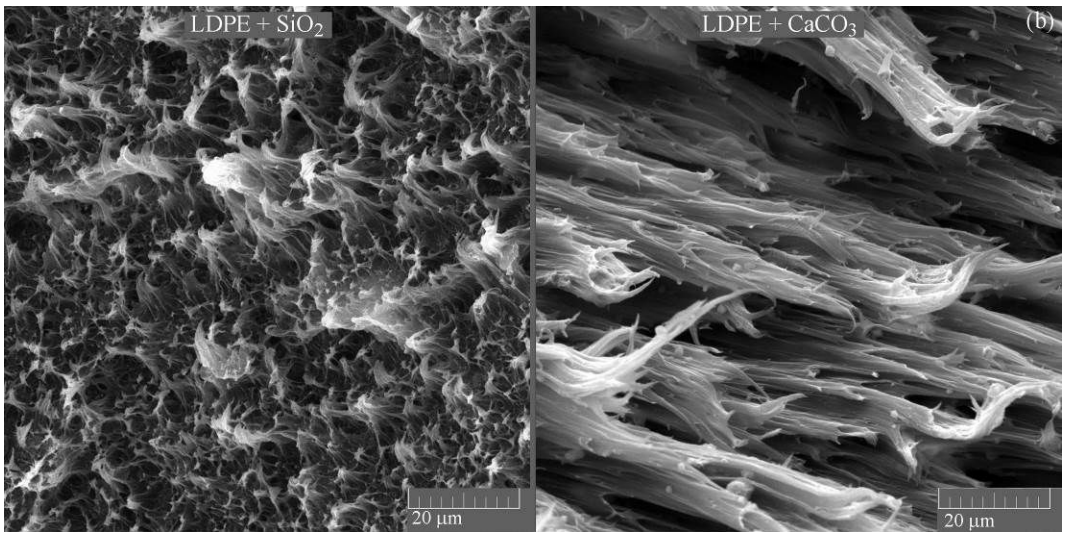

Fig. 1: The effects of nanofillers SiO_2 and $CaCO_3$ (5 wt%) in pure LDPE matrix