TAILORING OF CO-CONTINUOUS POLYMER BLENDS MORPHOLOGY: JOINT ACTION OF NANOCLAYS AND COMPATIBILIZERS

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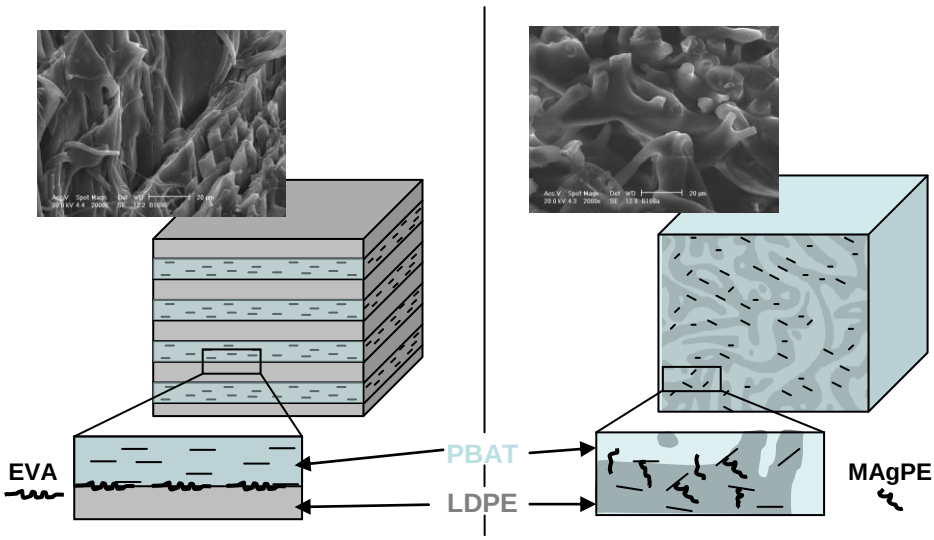
Polymer blends represent a large and rapidly growing fraction of all plastics produced. The opportune choice of the blend components and the control of microstructure can lead to multiphase systems with enhanced performances.

In a first part, the effect of both organically modified clay (Cloisite 30B) and compatibilizers (EVA copolymer or maleic anhydride grafted PE) on the morphology and mechanical properties of co-continuous structures is investigated. For that purpose, blends of low-density polyethylene (LDPE) and polybutyleneadipatetherephtalate (PBAT) (LDPE/PBAT 40/60 wt/wt) have been chosen as an environmentally friendly model. The influence of the nature of the nanoclay/compatibilizer pair on the morphology of the nanocomposite was thoroughly studied by means of scanning and transmission electron microscopies.



Depending of the compatibilizer, it has been found that the nanoclay can be selectively located in either the polyolefinic or polyester phase while the interphase is invariably stabilized by clay platelets. Remarkably enough, such a selection allows controlling the morphology of the polymer blends. The mechanical properties of the polymer blends were interpreted in the light of their morphology.

In a second part, the melt blending of poly(L-lactide) (PLLA) with biodegradable poly(butylene succinate) (PBS) is considered in a view to fine tune its mechanical properties. For this purpose, both maleic anhydride-grafted PLLA (MAgPLA) and maleic anhydride-grafted PBS (MAgPBS) were prepared and used as reactive compatibilizers. The influence of PBS melt viscosity on the morphology and the mechanical properties of PLLA/PBS blends are studied. Interestingly, the blending of low viscosity PBS with PLLA allows PLLA to be toughened while the use of high viscosity PBS led to PLLA/PBS blends exhibiting co-continuous morphology. The nanostructure of the co-continuous blends may be tuned through the joint action of organo-modified clays and reactive compatibilizers.

The so-obtained results evidenced that the joint action of nanoclay and compatibilizers allows tailoring the final properties of polymer blends, and pave the way for a new class of clay-based high-performance materials which combine the advantages of polymer blends and the characteristics of polymer nanocomposites.