POLYOLEFIN-BASED BLENDS; PREPARATION AND THEIR PERFORMANCE ANALYSIS

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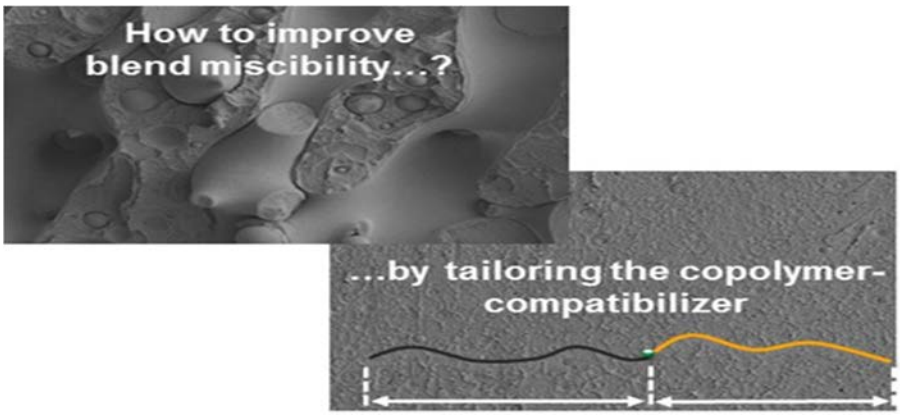
The most common method for enhancing cost/performance ratio of the polymeric materials is preparing blends of different homopolymers. Since most of polymer pairs are thermodynamically incompatible, their blending causes phase separation depending on the viscoelastic properties of the polymers. The final properties of polymer blends depend on blends composition and processing conditions. Besides, physical, mechanical, and optical properties of the blends are fully dependent on the blend morphology (size, shape of the dispersed phase, and continuity) and on the interfacial adhesion. Consequently, when creating new polymer blends, morphology improvement is crucial to optimize their properties. As a rule, a block or graft copolymer can be added or formed during the process of mixing and acting as a compatibilizer for polymer blends. The implementation of a compatibilizer can foster the refined morphology by reducing interfacial tension, suppressing phase coalescence, improving shear stress transfer or influencing viscosity and elasticity ratios between phases.



Preparation of polyolefins blends with other polymers can enhance following properties of the materials: high melt strength and elasticity, toughness, viscosity, polarity, dielectric constant, chemical resistance and moisture absorption resistance. Polyolefin-based blends reveal high modulus, heat resistance and oxygen or solvent barrier properties.

Recently, some interesting reports focusing on polypropylene (PP) blending with other compounds including polyethylene, polystyrene, poly(butyl methacrylate), polyamides, polyimides, polyurethanes, fluoropolymers, various rubbers, lignin, cellulose, polylactide were published [1-5]. For instance, blends of PP with polycarbonate can be used as material revealing balanced control of permeability and water retention.

Polypropylene is a multifunctional thermoplastic polymer, suitable for many processing techniques and used in many different commercial applications. PP exhibits many relevant properties as high flexibility, electrical resistivity, low density, relative high thermal stability,

mechanical toughness, low cost, resistance to chemical degradation, and easy (re)processing. Additionally, PP can be processed with the help of almost all methods such as injection molding, blow molding, extrusion, blown and cast film, as well as thermoforming. Due to its versatile properties and relative easy processing, PP is successfully applied in different commercial spheres including fibers, films, filaments, automotive parts, aircraft components, medical equipment, food packaging, clothing, roofing, loudspeaker drive units and other. On the other hand, the possibility of the polycarbonate usage as an engineering plastic is actively discussed by the technologists as this material offers great advantages over conventional materials such as the excellent combination properties of stiffness, strength, toughness, ductility, impact resistance, and transparency. Therefore the preparation of PP/PC blends is fully justified.

Polycarbonate and polypropylene are immiscible and not compatible with each other as their polarity and solubility parameters are completely different. As a result of the poor compatibility, a morphology with phase separation between the two polymers can cause the mechanical properties failure. The requisite for a successful blend preparation is the availability of an appropriate compatibilizer, which is typically a (multi) block- or graft-copolymer. In our work we applied iPP-graft-PCL copolymers synthesized via transesterification of PCL with hydroxyl-functionalized iPP to enhance the compatibility between PP/PC pairs. The polymer blends were tested in terms of their mechanical properties while the morphology was examined by SEM.

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References:

[1] Rutkowski, S.; Zych, A.; at al.: Macromol., 2017, 50, 107-122.
[2] C.R. López-Barrón and A. H. Tsou.: Macromol., 2017, 50 (7),2986–2995.
[3] X. Rong, Y. F. Chen, at al.: Chinese Chem. Lett. 2012, 23, 753–756.
[4] Feng, G. Zhang, at. al. Polymer.: 2017, 123, 301–310.
[5] Y. Xu, J. Loi, at. al.: Ind. Eng. Chem. Res. 2015, 54, 6108−6114