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Compatibilisation of Immiscible Blends by Triblock Terpolymers – Influence of Molecular Architecture on Morphology and Properties

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Polymer blends such as poly(2,6-dimethyl-1,4-phenylene ether) (PPE) and poly(styrene-*co*-acrylonitrile) (SAN) are often immiscible, resulting in a rough and disperse morphology. The incompatibility of the polymers leads to a reduction of properties such as toughness, due to low interphase strengths. In order to improve the mechanical performance, compatibilisers can be used to reduce the phase size and to allow a better force transfer between the phases. Block copolymers are often used as coupling agents to improve the miscibility of the polymers. In the past, the efficiency of block copolymers, consisting of two different monomers, has been demonstrated both in solvent-mediated and in melt processing approaches. A simultaneous increase of strength and toughness can be achieved by using triblock terpolymers. Poly(styrene)-*block*-poly(butadiene)-*block*-poly(methyl methacrylate) triblock terpolymers (SBM) are particularly useful as a compatibiliser in PPE/SAN blends. The interplay of block lengths and the interaction between the components results in the formation of a so-called “raspberry” morphology. The incompatibility of the elastomeric middle block both with the blend components and with the end blocks leads to a discontinuous, nanostructured distribution within the interface. Although the basics of solvent-mediated processing have been investigated, melt processing of such materials is more complicated, due to the number of increasing parameters, e.g. melt viscosity or shear rate. The triblock terpolymer concept for the improvement of immiscible polymer blends requires a reproducible and stable “raspberry” morphology, which can only be achieved through a basic understanding and systematic monitoring of the relevant processing and the materials parameters. In this study, the effects of block lengths and concentration of SBM on the resulting morphology have been correlated with the processing behaviour and the micromechanical properties of blends based on PPE and SAN.