Effect of Silica Nanoparticles on Morphology and Properties of InjectionMolded Immiscible Polymer Blends

Fouad Laoutid, Yoann Paint, Leila Bonnaud and Philippe Dubois

Center of Innovation and Research in Materials & Polymers (CIRMAP), Laboratory of Polymeric and Composite Materials (LPCM), University of Mons UMONS & Materia Nova Research Center, Place du Parc 20, 7000 Mons, Belgium (fouad.laoutid@materianova.be, www.materianova.be / http://morris.umons.ac.be/smpc)

The stabilisation of immiscible polymer blend morphology can be achieved by using compatibilizing agents which present a chemical affinity with the two polymer phases. Nanoparticles could present an interesting alternative to the use of these conventional compatibilizing agents since they can confine, under certain conditions, at the polymer blend interface and form a rigid barrier that prevents coalescence. Unlike organic compatibilizers that need to be chemically adapted to each polymer pair, nanoparticles can be localized at the interfaces by effects of nanoparticle-polymer affinity through the interfacial energy [1, 2] and their use could provide a universal way for the interfacial compatibilization of immiscible polymer blends, which could be advantageous especially for plastic recycling.

The purpose of this work is to investigate the effect of nanosilica, on morphological, mechanical and thermal properties of polyamide-6/ polypropylene (PA/PP) immiscible blends [3]. Different morphologies were obtained as highlighted by transmission and scanning electron microscopies. The incorporation of 5 wt% of hydrophobic nanosilica that migrated mainly at the interface prevented dispersed phase domains from coalescence leading to a clear refinement of dispersed droplet size. The macroscopic properties of the hybrid blends were discussed and interpreted in relation with the blend morphology and melt mixing procedure. The control over coalescence allowed a morphology refinement of the blends (Figure 1) and improved mechanical properties except in the case of blends containing PA as minor fraction (Figure 2).

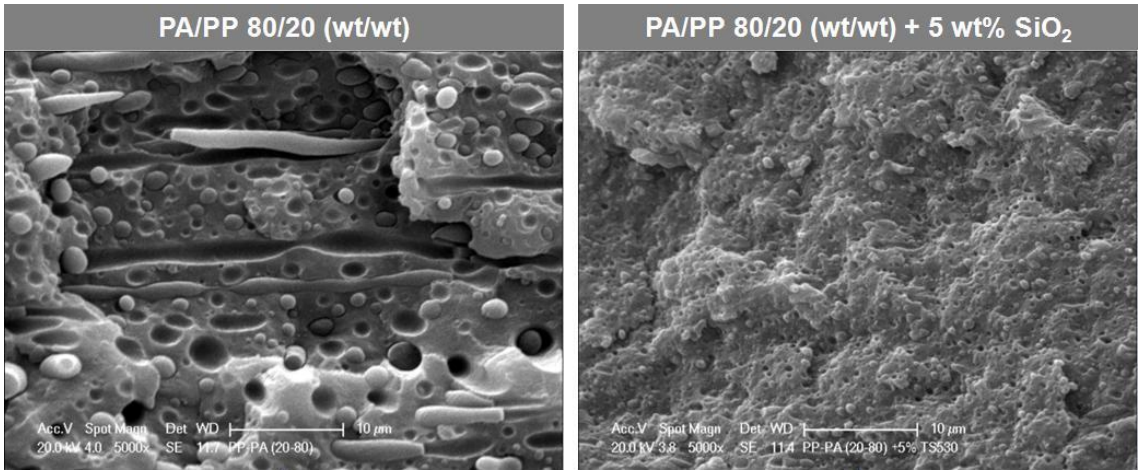

Figure 1 : effect of hydrophobic silica nanoparticles on PA/PP (80-20; wt/wt) blends morphology and ductility.

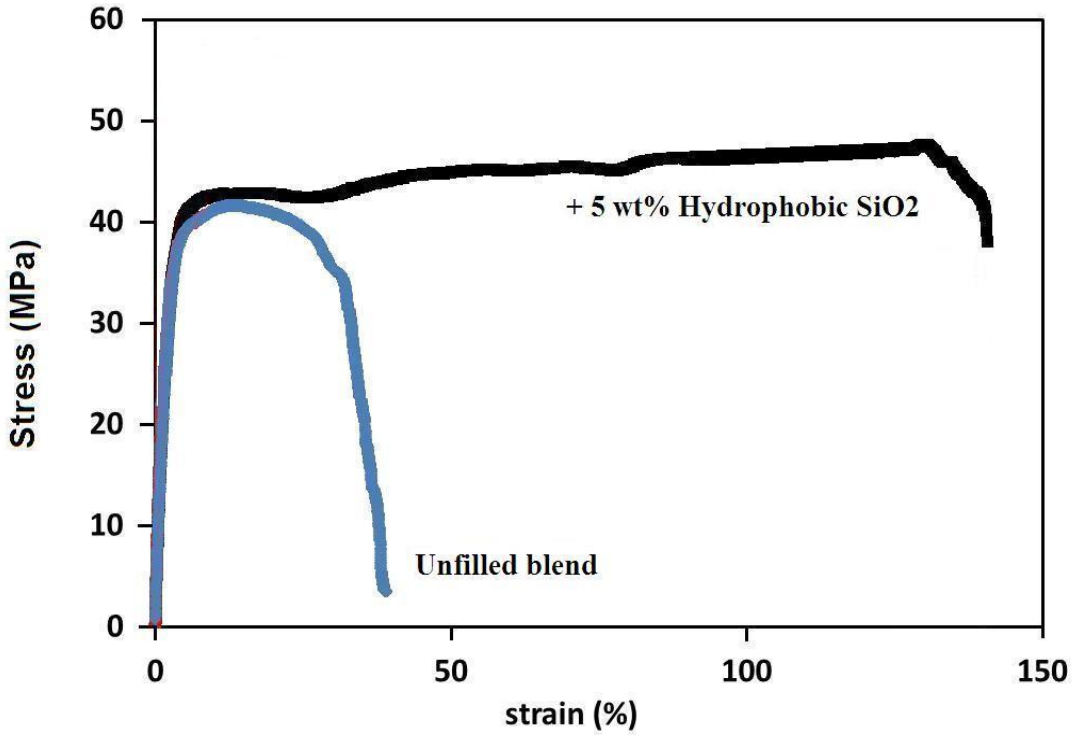

Figure 2 : Stress / Strain curves of PA/PP (80/20; wt/wt%) blends unfilled and filled with 5wt % of hydrophilic silica nanoparticles

References

1. L. Elias, F. Fenouillot, J.-C. Majesté, G. Martin, Ph. Cassagnau, *J. Polym. Sci. Pol. Phys.*, **2008**, 46, p. 1976

2. F. Fenouillot, P. Cassagnau, J.-C. Majesté, *Polymer*, **2009**, 50, p. 1333

3. F. Laoutid, D. François, Y. Paint, L. Bonnaud, Ph. Dubois, *Macromol. Mater. Eng.*, **2012**, in press