



IMPACT OF NANOPARTICLES ON THE ONSET OF CO-CONTINUITY OF IMMISCIBLE BLENDS

G. Filippone*, D. Acierno

*Department of Materials and Production Engineering (DIMP), University of Naples Federico II, P.le Tecchio 80, 80125
Naples, Italy*

** Corresponding author: gfilippo@unina.it*

Polymer mixtures tend to phase separate because of the low mixing entropy of the polymers. In binary mixtures immiscibility usually results in droplet-matrix morphologies. The properties of such a system generally range between those of the neat constituents, being often governed by the matrix phase. Within a narrow range of compositions and/or using appropriate processing expedients, a particular arrangement of the phases known as co-continuity can be obtained. The distinguishing feature of co-continuous blends is the mutual interpenetration of the phases, which result both continuous. Dealing with this class of materials is often desirable because of the enhanced properties stemming from the synergism of the constituents. As a consequence, a remarkable scientific and technological interest exists in identifying simple and versatile routes for promoting and stabilizing co-continuity. For this purpose the using of nanoparticles has recently revealed as an elegant alternative to chemical compatibilizing agents. The filler generally distributes unevenly inside the phases because of the different affinity with the polymeric constituents. This causes substantial alterations of the microscale arrangement of the phase, which eventually results in a shift of the phase inversion composition. In this work we deal with this issue by comparing the effect of different kinds of nanoparticles, differing among them in terms of shape and surface properties, on the occurrence of co-continuity in immiscible blends. We find that the size of the minor phase is drastically reduced by particles adsorbed at the polymer-polymer interface. However, in order to alter the co-continuity threshold, the nanoparticles have to substantially slow down the melt state relaxation dynamics of the interface. This hinders the shape relaxation processes, thus preserving the finely interpenetrated microstructure attained during the melt mixing. In conclusion, our preliminary results show that interface rheology plays a major role in driving the morphology on nanofilled blends.