Tuning localization of functionalized MWNT in PC/SAN blends

Gültner Maren, Göldel Andreas, Pötschke Petra

The influence of a reactive component (RC, N-phenylmaleimid styrene maleic anhydride) on the blend morphology, the localization of functionalized multiwalled carbon nanotubes (MWNT), and the electrical resistivity of the MWNT filled blend systems of polycarbonate (PC) and poly(styrene-co-acrylonitrile) (SAN) was investigated. The systems of PC, SAN, amino-functionalized MWNT (Nanocyl® 3152), and the RC were melt mixed in a DSM Xplore microcompounder. The RC containing maleic anhydride groups is miscible with the SAN and is assumed to enhance its polarity and surface tension. On the other hand it has the potential to form chemical bonds towards the functionalized MWNT. By analyzing the blend systems with and without the RC co-continuous structures as well as the localization of the MWNT in one of the blend phases could be achieved. The influence of the reactive component on the morphology of the blend systems was studied at different ratios of PC and SAN, whereas for all blends with 40 wt% SAN and 60 wt% PC co-continuous morphologies were found. In non-modified PC/SAN blends the MWNT are localized in the PC phase independently from the mixing procedure used, even if the carbon nanotubes were first mixed into SAN and then blended with PC. However, the modification of SAN using RC can change its properties in such a way, that the MWNT localize in the SAN-RC phase. This was found as well for mixing CNT first in SAN-RC, in PC, or adding all components together as well as adding RC to the ready PC/SAN/MWNT blend. The localization of the MWNT after addition of the RC depends on the concentration of the MWNT and the RC. By adapting that ratio and the mixing strategy, the localization of the carbon nanotubes can be tuned. The investigations have shown that the MWNT once coupled with the RC remain in the SAN-RC phase. Thus, a chemical reaction and/or strong interactions seem to be the driving forces for localization of the MWNT in SAN-RC.