Recycling of PA66/Silicone-wastes

S. Pagel, S. Weinmann, C. Bonten

Institut für Kunststofftechnik (IKT), University of Stuttgart, Pfaffenwaldring 32, 70569 Stuttgart
phone: + 49 (0) 711 685 62832, email: sandra.weinmann@ikt.uni-stuttgart.de

Abstract: Multi-layer materials are often used in technical parts to achieve certain properties of products and thus adapt their property profile to the respective application. However, a major challenge of plastics recycling is the separation of the various polymer components. One example for this are airbags. Airbags consist primarily of polyamide 6.6 (PA66) fibers and an additional silicone coating. During recycling, the silicone layer cannot be mechanically separated from the synthetic fiber. Therefore, the silicone particles remain in the recyclate with a poor bonding to the PA66 matrix. This can lead to poor mechanical properties of the recycled material and early material failure due to interface detachment. In this work, a new recycling strategy for the functional integration of silicone particles is demonstrated using the example of airbag waste. Reactive compounding of the wastes with a silane-coupling agent in a twin-screw extruder was conducted and led to a strong coupling between the silicone particles and the PA66 matrix. Rheological tests confirmed the formation of a cross-linked structure by adding the coupling agent. Nano-IR-AFM analyses demonstrated the improved integration of the silicone particles into the PA66 and the reduction of cavities in the compound. Mechanical tests showed the increase in notched impact strength and elongation at break and therefore the possible function of the silicone as an impact modifier. However, a further analysis of the process in a hinged twin-screw extruder emphasized the need for an adjustment of the machine parameters as well as the screw concept in order to optimize the reaction conditions in the processing zone and to prevent post-reactions and degradation effects.