Re-gradation of industrial polyamide 6. Comparison of different chain-extenders.

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The re-processing of polyamide waste with specific additives (stabilizers, chain-extenders) represents one of the most interesting technique in the field of recycling. The objective of this work is to evaluate the effect of different commercial chain-extenders on the rheological and thermo-mechanical properties of industrial polyamide 6. Four different molecular weight polyamides were considered and three chain-extenders were used: (i) polycarbonate-polyamide blends with acid terminations (PCPA) [1], (ii) 1,3-phenylene-bis-2-oxazoline (PBO) and (iii) N,N'-carbonyl-bis-caprolactam (CBC) [2,3,4]. The effectiveness of chain-extenders has been evaluated through rheological tests, relative viscosity measurements and end groups determination analysis. The thermal properties were investigated by DSC analysis, and mechanical properties were measured by tensile test. Polyamide chain-extended by PCPA showed an interesting increase in both apparent and relative viscosity, proportionally to the amount of additive and to the residence time at high temperature. The end groups determination confirmed a progressive increase in molecular weight with the amount of PCPA. While the melting and crystallization temperatures were not influenced by chain-extension, the addition of PCPA caused a reduction of crystallinity. Furthermore, both the elastic and yield properties of chain-extended polyamide were very close to those of the virgin polyamides with similar molecular weight; in the same time a higher deformation at break was measured. On the other hand, the CBC and PBO chain-extenders showed lower effect compared to PCPA.
In conclusion, the use of a commercial chain-extender based on PCPA was found to be an effective method for re-gradation of polyamide 6.

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