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TOWARDS EFFECTIVE UPCYCLING OF POLYOLEFINES

GIULIA BERNAGOZZI[1], ALBERTO FRACHE[1], ROSSELLA ARRIGO[1]

[1]*Department of Applied Science and Technology, Politecnico di Torino, Viale Teresa Michel 5, 15121 Alessandria, Italy;*

Email: giulia.bernagozzi@polito.it

Role: PhD student 1° year

Abstract

The new circular economy policies developed in the recent years due to the increasing environmental awareness of society are changing the traditional way to design plastic products, in order to provide greater durability, reuse and high-quality recycle. The circular economy model suggests a rational utilization of the resources and promotes the valorization of the plastic materials already in circulation through recycling strategies. However, the market data of the last years indicate that the global economy of plastics is largely linear, with the disposition (with no recovery after their utilization) of more than half of the total amounts of plastic products produced per year. Therefore, there is an urgent need of increasing the recycling rate of plastics, to make the plastic industry more sustainable and compliant with circular economy policies. Among the different recycling technologies, mechanical recycle is the preferred option from both energetical and ecological point of view, as it ideally allows fully replacing the pristine polymers with materials recovered form wastes. Nevertheless, mechanical recycling strategies are really effective if closed-loop processes are realized. Actually, the degradation phenomena occurring during the re-processing significantly affect the polymer processability, also causing a progressive deterioration of the final properties of the secondary materials, with a consequent economic disadvantage of recycled polymers compared to their pristine counterparts. In this work, the effect of multiple re-processing cycles on the final properties of pre- and post-consumer polyolefines scraps was investigated. The materials were subjected to re-processing operations in a twin-screw extruder, and the rheological behavior, crystallinity degree and mechanical properties were evaluated as a function of the processing cycles. Furthermore, the influence of the introduction of a commercial chain extender additive was also evaluated.