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Efficiency of Reactive Extrusion in PET Recycling

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Poly(ethylene terephthalate) (PET) is a linear thermoplastic polyester, known as a global packaging material in many applications, especially in beverage bottle manufacture. PET bottles undergo mainly hydrolytic and partly thermo-oxidative degradation during their manufacture process and throughout their use. This degradation causes deterioration of the polymer properties and thus, impedes the potential of their re-use in respective applications. For this purpose, the use of the so-called chain extenders has been proposed in many studies for improving material properties. Chain extenders are low molecular weight compounds, bifunctional and capable of a fast reaction with polymer chain ends, in order to increase molecular weight. This coupling of the polymer macromolecules is promoted through reactive extrusion comprising a very flexible and one step process. In this paper, the effectiveness of the reactive extrusion process is thoroughly investigated in the case of PET recycling and more specifically in the case of industrial PET Scrap and of post-consumed bottle PET grade. The contribution of a commercial available chain extender for the improvement of the recycle quality is studied in detail, so as to evaluate its ability to increase the melt strength and melt viscosity of PET grades and to match the properties of the virgin polymer, thus permitting reuse in the initial application (closed loop recycling). Different amounts of the additive were examined, in order to investigate the effect of the chain extender content on polymer modification. Subsequently, rheological and thermal characterizations were performed on treated PET extruded samples.