OPTIMIZING REACTIVE EXTRUSION OF RECYCLED PET THROUGH RHEOLOGY

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PET is a thermoplastic polymer used in many applications, including packaging, construction, and household products. PET manufacts are frequently dispersed in the environment, therefore its recycling is of great interest in a circular economy strategy. Recycled PET from bottles (and packaging in general) can be reused in many different ways: one of these is the production of foams for lightweight applications. In order to be suitable for this kind of manufacturing, recycled PET must be modified ad hoc through a reactive extrusion process; such a method involves the reaction of linear PET with small functional molecules, known as chain extenders, which can join two or more PET molecules to form either larger linear or branched structures.

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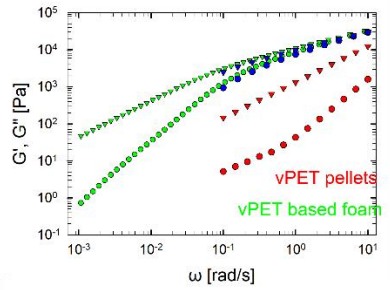

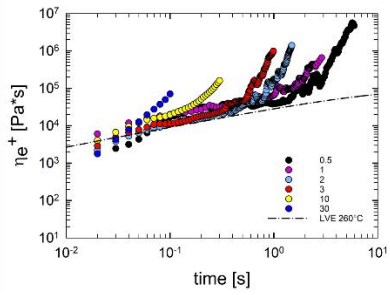

The goals of my project are to understand and improve the reactive extrusion process of PET. The modification of PET through reactive extrusion implies modifications of the molecular structure, thus it strongly affects the flow properties. Therefore, shear and extensional rheology are among the best techniques to investigate the process.

The project is in collaboration with Gurit Italy S.r.l. and it consists of three different phases: the experimental analysis of materials before, during and after the reactive extrusion process; the modelling of the various process operations; the evaluation of the real process conditions on-site.

The objective of the first year is the rheological characterisation, in shear and in extensional flow, of raw materials and finished products; in addition, the kinetics of chain extension reactions will be studied using various rheological procedures. During the second year, the on-site process will be investigated, with emphasis on both the reactive extrusion and foaming stages; models will also be developed for the kinetics of chain extension and in general for the different

process stages. Finally, the third year will be spent developing and improving the correlation between input variables, process conditions and the final product.

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