



Title: REACTIVE EXTRUSION POTENTIAL IN RECYCLING AND REPOLYMERIZATION

Abstract:

The presentation will give an overview of the potential that reactive extrusion (REX) technology can show in the framework of recycling and synthesis of new polymers afterwards.

Reactive extrusion makes use of an extruder as a continuous chemical reactor. It is not a recent process, but it has been rapidly developed during the last thirty years and is more and more used today for the chemical modification of existing polymers. Among the various extrusion systems (single screw extruders, counter- and corotating twin-screw extruders, co-kneaders), the corotating twin-screw extruders are today the most widely used in reactive extrusion. Reactive extrusion has been considered as a Green Chemistry Technology due to these main advantages: continuous process, very short process times (few minutes against hours in reactors) and as consequence lower energy consumption, avoid the use of solvents or minimizes in a relevant amount its use reducing or eliminating therefore VOC emissions, allows working with highly viscous materials, etc.

A number of reactive systems are today involved in reactive processing, such as chemical modification of molten polymers, bulk polymerization, reactive compatibilization of immiscible polymer blends, *in situ* polymerization and/or crosslinking, etc. In the industrial developments of many polymer formulations for new materials, reactive extrusion is generally the most viable technological and economic solution because it allows several formulation steps to be combined in terms of compatibilisation, viscosity control, purification (devolatilization of volatile organic compounds), et.

REX can be used in the field of recycling (mechanical and chemical) in a huge amount of different processes and with different materials. Thus, can be used for lignocellulosic treatments to separate the three components (lignin, hemicellulose and cellulose), thermomechanically degrade plastic waste to make easier a posterior process like for example enzymatic degradation, thermo-mechanical devulcanization of rubbers, depolymerization of PET in the presence of ethylene glycol, etc.

It is important to highlight that the monomers or oligomers produced from a recycling process (which can be made by REX in the same extruder or coming from other recycling processes) can be repolymerized by REX if the kinetics of the polymerization process is appropriate. Examples of these polymerizations include synthesis of PLA, PCL, PA6, TPUs...

A great opportunity of REX covers also the increase of the molecular weight and quality of recycled polymers which have shown some degradation, so we can reach a high-quality recycled material following this protocol.

