REACTIVE EXTRUSION: AN OLD TECHNOLOGY FOR A NEW SUSTAINABLE CHEMISTRY?

Véronique Bounor-Legaré

Polymer Materials Engineering Laboratory
Université Claude Bernard Lyon 1 (France)
veronique.bounor-legare@univ-lyon1.fr

Extrusion is a classical continuous process in which many types of fluids, such as polymers, are conveyed and transformed within a barrel/screw system. We speak of reactive extrusion when there are chemical reactions involved in the process. In the polymer world, the significant advantages of extrusion over conventional batch processes is that it enables new materials to be prepared continuously and in bulk, i.e. conventionally in high-viscosity media and solvent-free conditions. Nevertheless, reactive extrusion in the polymer field combines the difficulties associated with their implementation with the constraints imposed by the control of a chemical reaction under very specific conditions, such as a high-viscosity medium ($\eta \sim 10^3$ Pa.s), high temperatures (up to 400°C) and short extruder residence times (a few minutes).
Numerous chemical reactions have been carried out by reactive extrusion, such as grafting and functionalization reactions, polymerization or depolymerization reactions, synthesis of new copolymers, blend compatibilization and synthesis of vulcanized thermoplastic materials (TPV)[1]...
With the demand for environmentally-friendly processes in organic chemistry and biomass upgrading for example, the development of original solvent-free experimental conditions involving a continuous system is attractive. In 2019, the International Union of Pure and Applied Chemistry (IUPAC) has listed reactive extrusion as one of the 10 chemical innovations that will change the world.[2] This presentation is intended to illustrate, in a non-exhaustive way, the basis for this ranking, which we have been developing for 35 years in our laboratory.

[1] V. Bounor-Legaré V, P Cassagnau P, Extrusion réactive : Des aspects fondamentaux aux développements industriels –Hermès Science Publication- Edition Lavoisier- 13 novembre 2019
[2] Gomollón-Bel F, Chemistry International April-June 2019, 12-17.