CHEMICAL ENGINEERING

POMINI - Theoretical-experimental study of a counter-rotating twin-screw interpenetrating extruder for filtering elastomer-based compounds.

Funded By	POMINI RUBBER & PLASTICS S.R.L. [P.iva/CF:05699990965]

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Context of the research activity	The work aims to apply computational fluid dynamics techniques to the optimization of a counter-rotating twin-screw extruder for processing rubber-based compounds. The study will then be complemented by the analysis of possible developments of this technology.

Objectives	The work is carried out in collaboration with the company Pomini Rubber & Plastics and involves the study of a counter-rotating twin-screw extruder using computational fluid dynamics. Numerical simulations will be carried out with CFD codes that can accurately describe the non-Newtonian behaviour of the fluid and will be validated both by experiments carried out by the student at the company and by analysis of the extruded material to be carried out at Politecnico. The constitutive equations for viscous stress will be experimentally evaluated from the rheological curve of the material. Based on the comparison between simulation and experiments, the student should identify the most appropriate boundary conditions with regard to wall friction, slip and heat transfer. The aim of the work, once the method has been validated, is to apply it predictively to different materials, enabling rapid optimization of process conditions even on new compounds. Indeed, CFD analysis provides detailed information on local and average velocity, pressure and temperature distributions along the extrusion axis, shear rate, shear stress, flow number, leakage/backflows, torque, and specific energy.

Skills and competencies for the development of the activity	For the topic under consideration, the candidate is required to have, in addition to general competence in industrial engineering, a basic knowledge of computational fluid dynamics, scientific programming, and the transport mechanisms of momentum, energy, and mass. Furthermore, familiarity with the behavior of non-Newtonian fluids and the methods used to characterize their rheology would be highly beneficial.