12-month post-doctoral position

Elastic instabilities in rubber materials during extrusion

Extrusion is a key step in the processing of polymer melts involved in the design of rubber materials, specifically for tyre applications. Formulations of tyre tread materials are currently undergoing a major evolution to reduce rolling resistance. However, certain formulations lead to the appearance of surface defects under extrusion that are not acceptable for industrial applications. Recent studies have revealed that rubber may undergo elastic instabilities during the flows involved in the processes leading to such defects. One way to secure the extrusion step is to better understand the fundamental mechanisms linking the flow process to the material response.

The goal of this post-doctoral fellowship is to quantitatively characterize these flow instabilities in a non-invasive manner using an ultrasonic velocimetry technique. The first step will be to set up the experimental device on a laboratory extruder and then to characterize locally the rubber flow field during the extrusion process. This device will enable us to identify the most sensitive materials according to their formulation and as a function of the applied mechanical stresses.

This study will be carried out as part of a collaboration between Sébastien Manneville of the Physics Laboratory at ENS Lyon, Sandra Lerouge of the Matter and Complex Systems (MSC) Laboratory at the University of Paris, and the Michelin company. This 12-month project will take place mainly at the Michelin R&D site in Clermont-Ferrand.

Host institutions and laboratories : Laboratoire de Physique (ENS de Lyon/CNRS), Laboratoire Matière et Systèmes Complexes (Université de Paris/CNRS), Michelin.

Expected skills : junior researcher with less than two years of post-doctoral experience and trained in polymeric materials, fluid mechanics, rheology, instrumentation.

Gross salary : $\sim$ 2500 € per month. Technically, the contract will be split into 2×6 months, funded first by ENS Lyon and then by CNRS.

Deadline : The selection will start in July 2020. The project is scheduled to start on October 1st 2020.

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