Multilayer packaging waste processing by dissolution/precipitation

Objectives and context:
Packaging waste generated in the EU totaled an estimated 83.4 million tons in 2022, with a significant contribution from paper and cardboard materials, followed by plastic and glass packaging. Among packaging, multilayer packaging has gained importance due to its ability to provide enhanced characteristics. However, due to the material's heterogeneity, it becomes challenging to recycle. A significant proportion of paper-based multilayer packaging waste is hydro-pulped to recover the cellulosic fibers, which have high recycling values. The remaining solid residues (mixtures of plastics, metals, and residual cellulosic fibers) are mostly landfilled or incinerated, which causes environmental issues.
The suggested MSc project is part of PAC-3R (ANR-22-PERE-0004), which focuses on valorizing solid residues after the recovery of fibers from paper-based multilayer packaging waste using alternative technologies (Pyrolysis, thermo-oxidation, and dissolution/precipitation).
Here, we suggest evaluating the feasibility of selective dissolution precipitation for valorizing the paper-based multilayer packaging components. The student will work on optimizing the recovery of polyethylene by inducing precipitation of PE with various proportions of isopropanol in PE-xylene solutions at controlled temperatures (various temperatures will be tested). After a specific residence time, the suspensions will be filtered. The washed and dried retentate will be weighed to determine PE yield. Experiments will be conducted on waste material at the lab scale to obtain mass and energy balances at a temperature and isopropanol/xylene ratio that yielded the best results during optimization. A series of analytical techniques (GPC, SEM, CHNS-O, ICP, and TGA-DSC) will be employed to characterize both pristine and recycled polyethylenes.

Deliverables: Mass and energy balances, analyses of raw and recycled products

Keywords: Multilayer packaging, dissolution, precipitation

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Duration: February – August 2026 / **Location:** IMT Mines Albi

Pre-requisites: MSc student in 2nd year or 5th year in an engineering school. Motivation and the ability to work in a team are essential skills for this internship.

Project nature: Part of PAC-3R (ANR-22-PERE-0004)

Application process: A complete application must be sent (in pdf format) containing:

- CV for MSc applications (Education and Research/Professional experience)
- Academic cover letter explaining the suitability of your knowledge and expertise for the project.