Science @ifpen
N° 58 - Mai 2025

Written on 16 May 2025

15 minutes of reading

News

Fundamental Research

Performance data acquisition in representative industrial-scale conditions is a key step in the development of new processes. More often than not, it requires pilot-scale experimentation. Thermal and matter transfers must be fully controlled on this scale, given extrapolation factors in the region of 10^5 to 10^6 between a pilot facility reactor and an industrial unit reactor. For highly technological processes, an intermediate scale (10^2 to 10^3) may be necessary to make extrapolation as reliable as possible in economic, technical and operational terms.

IFPEN's Process Experimentation Division is involved at all phases on both these scales: design, launch, production start-up, data processing and plant maintenance. It has a pool of 75 pilot units at the IFPEN-Lyon site, covering all IFPEN applications involving catalytic and/or separation processes. On average, it works on one to four demonstrators per year located on industrial sites.

To reinforce its expertise supporting this experimentation, the division relies on fundamental research centered around three main areas:

1. **online analysis** for real-time control of units,

2. **data sciences** including **Artificial Intelligence** to optimize the conduct and operation of pilot tests**,**

3. **control of physical and chemical phenomena** within these facilities for the acquisition of representative data.

This issue of Sciences@IFPEN, dedicated to the “Process Experimentation” Division, presents six articles illustrating our developments in these three areas.

The design of pilot tools for advanced plastics recycling will be presented through a major infrastructure**: the PROPRE platform.** Two highlights concerning **online analysis techniques** will illustrate the essential aspects of characterizing and controlling these same plastics recycling processes.

The digitalization of pilot units and **an example of the use of AI to transfer knowledge** from a historical domain to a new information technology domain will then be presented.

Finally, we will showcase **the use of numerical tools** such as **computational fluid dynamics**, essential for understanding and controlling the physical phenomena at play in pilot units.

We hope that you enjoy this issue,

Denis GUILLAUME, Director of the Process Experimentation Division

Lionel GAMET, Scientific Assistant Director

Summary:

Tool design:

1. An innovative platform for the chemical recycling of plastics
   Aline GREZAUD

Process control and online analysis:

2. Spectral methods for online monitoring of a polyolefin recycling process
   Maud Rey-Bayle

3. Hyperspectral camera characterization of plastic recycling flows
   Noémie Caillol

Digitalization and AI:

4. Pilot unit digitalization
   Alice Faure

5. Knowledge transfer to new energies
   Victor Costa

Simulation for the mastery of physical phenomena:

6. Numerical simulations of reactive Taylor flows
Lionel Gamet

Issue 58 of Science@ifpen - Experimentation and Processes
16 May 2025

Link to the web page :