
Innovation in Flow Chemistry: KHIMOD and the University of Liège Tackle Solid Management

Liège and Wissous, May 15, 2024 — KHIMOD, a company specializing in the development of heat exchanger-reactors for energy and flow chemistry, in collaboration with the FloW4all technological resource platform at the University of Liège (Belgium), is initiating an innovative program aimed at enhancing the management of solid compounds formed during chemical reactions. This breakthrough involves the deployment of a patented process by KHIMOD that facilitates the integration of its heat exchanger-reactors.

This technology leverages KHIMOD's expertise in developing exchanger-reactors for catalytic hydrogenation reactions within the industry. As a groundbreaking innovation on a global scale, it will undergo real-world testing by the FloW4all teams. The trials will focus on applications within the pharmaceutical industry and the production of high-value compounds in fine chemistry.

Flow chemistry has seen significant advancements recently, both in academic and industrial settings. However, this innovative technology encounters a substantial challenge when the reactions produce solids. Specifically, precipitation reactions can cause fouling and blockages in reaction channels. Experts estimate that more than 60% of the reactions applicable to flow chemistry involve solid materials. Although effective solutions are available for scenarios where solids are added to the reactor, the industry still lacks a satisfactory method for managing solids that form in situ within the reactor.

KHIMOD and **FloW4all** are embarking on a collaboration that utilizes an innovative technology which combines KHIMOD's heat exchanger-reactors with ultrasound to manage solids effectively. Integrating ultrasound with KHIMOD's monolithic exchanger-reactors enables controlled solid precipitation without the usual drawbacks, such as system clogging.

This patented technology is particularly valuable for industries where the purity and precision of chemical processes are critical, such as pharmaceuticals, perfumery, agriculture, and cosmetics. These sectors will benefit not only from the system's robustness and stability but also from its adaptability to various industrial applications. By effectively managing solids, this technology paves the way for smoother, safer production with fewer disruptions caused by frequent reactor cleanings, thus optimizing production time and reducing costs.

A specially designed exchanger-reactor was delivered today to FloW4all from KHIMOD's production site in the Paris region. This equipment will be central to two major research and development focuses :

1 Proving the device's effectiveness through empirical studies :

The goal is to demonstrate the system's effectiveness using model reactions and application scenarios in the industry. These studies will validate the performance of the exchanger-reactor under varied conditions and provide empirical data on how the technology can be adapted and optimized for specific applications. This research phase will help refine processes and demonstrate the system's flexibility and performance across different industrial settings.

2 Toward Industrialization for the Pharmaceutical Sector :

Demonstrate the ability of the exchanger-reactor to maintain continuous reactions, even when solids form, for the continuous flow production of fine chemical products.

Explore innovative methods of solid management to reduce the risks of clogging, thus increasing the overall efficiency of the processes.

Enhance solid precipitation to better control the size of the particles formed.

Implement this breakthrough technology under extreme temperature and pressure conditions, as KHIMOD's exchanger-reactor are already recognized in the flow chemistry market for their capability to operate at up to 93 bars and 560°C.

These research efforts will lay a solid foundation for the development of more efficient processes in highly regulated and technically demanding sectors, while also highlighting the commitment of KHIMOD and FloW4all to innovation and applied research.

For several years, KHIMOD has stood out for developing heat exchanger-reactors renowned for their reliability and high performance, even under extreme pressure and temperature conditions. These reactors are widely adopted in the industry for catalytic hydrogenation reactions, underscoring their proven effectiveness.

«We are extremely proud to collaborate with FloW4all, a platform globally recognized for its expertise in flow chemistry. This partnership marks a new phase in our development, as it represents the first industrial application of our latest technology that combines our heat exchanger-reactor with ultrasound, previously validated only in an academic setting. Transitioning from academic to industrial has always been our goal, but we needed a partner with the necessary skills and vision to overcome scaling challenges. We are confident that this technology, now ready for scaling, will open new avenues for continuous chemistry across various industries.»

Eric Aubay, Vice President of Flow Chemistry at KHIMOD.



«The partnership with KHIMOD is a strategic opportunity to enhance the diversity of our technological offerings at FloW4all. The ability to efficiently manage solids in mesofluidic reactors opens up new avenues that we are eager to explore,»

Jean-Christophe Monbaliu, Director of FloW4all.



About KHIMOD :

KHIMOD is a climate-tech company which develops innovative heat exchanger-reactors for flow chemistry, with outstanding performances at extreme temperature or pressure and with a strong focus on industrialization at large scale. The high modularity of KHIMOD equipment makes it suitable for a broad range of applications. KHIMOD equipment delivers exceptional performances on hydrogenation, with or without fixed bed catalyst.

Initially developed for the nuclear and energy industry, KHIMOD technology is now available for the fine and specialty chemical industries. Besides its HERs, KHIMOD designs and manufactures turnkey systems to produce e-methane, e-methanol and e-fuels, allowing H₂ transformation and CO₂ reuse and valorization.

For more information : khimod.com

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About Flow 4 All :

FloW4all is a technological resource platform affiliated with the University of Liège, established in 2022 under the auspices of the Center for Integrated Technology and Organic Synthesis (CiTOS, <http://www.citos.uliege.be/>) with the support of the Walloon government. It aims to provide services to academic and industrial partners for the integration of continuous flow chemistry. In addition to the technological opportunities offered under the «Corning Qualified Laboratory» label, FloW4all offers a wide range of micro- and mesofluidic technologies.

As a professional interface for industrial partners, FloW4all is a crucial hub for innovation and the practical application of continuous chemistry, meeting the specific requirements of research and development projects at an industrial scale. FloW4all is committed to transforming traditional chemical processes into more efficient, safer, and environmentally friendly methods, while strengthening the link between industry and academia.

Pour en savoir plus : flow4all.uliege.be

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