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Flow Chemistry

Flow Chemistry Highlights

Review of Recent Literature on Flow Chemistry.

Selected Topic: Electrochemistry

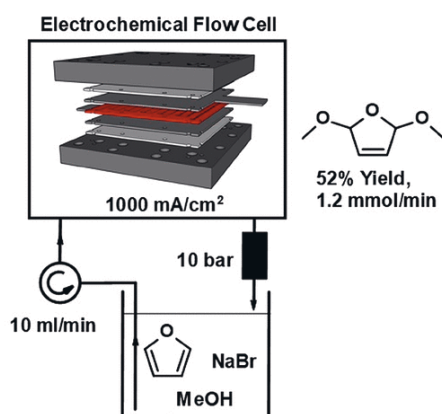
An Electrochemical Flow-Through Cell for Rapid Reactions

Matthias Lehmann, Christopher C. Scarborough, Edouard Godineau, and Claudio Battilocchio*, *Ind. Eng. Chem. Res.* **2020**, *59*, 7321, <https://doi.org/10.1021/acs.iecr.0c00431>
Syngenta Crop Protection, Stein, Switzerland

Laboratory-scale flow cells for electrochemical synthesis often suffer from low current density, necessary to avoid device overheating and extensive gas formation, as well as poor mixing due to laminar flow. In this paper, the authors construct a small-scale device which can operate with scalable current densities of up to 1000 mA/cm² and offers improved mixing thanks to the built-in static mixers. Fluidic channels are formed from a thin layer of perfluorinated elastomer cut to the required dimensions and geometry. The device can be pressurized up to 45 bar, increasing gas solubility in the reaction mixture. The potential of the device was demonstrated on an oxidative methoxylation of furan, performed in recirculating mode at 10 bar pressure. A 3-hour run with a reaction time of 17 min, defined as time needed for the whole reaction mixture to pass through the cell, yielded 30 g of desired product while using an anode surface area of only 8.9 cm².

Author's comments:

"Electrochemistry has huge potential for the chemical industry. We hope our efforts will inspire other scientists to push the boundaries of the field of electrochemistry while addressing the challenges of translation across scales."



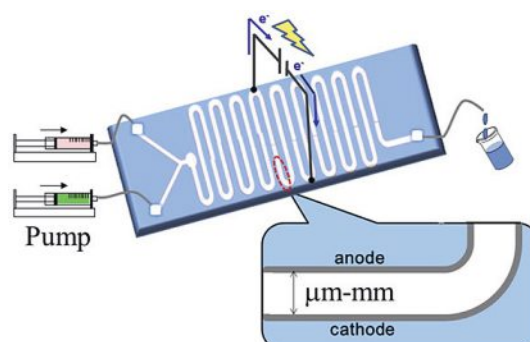
Applications of Flow Microreactors in Electro-synthetic Processes

Mahito Atobe*, Hiroyuki Tateno, and Yoshimasa Matsumara, *Chem. Rev.* **2018**, *118*, 9, 4541, <https://doi.org/10.1021/acs.chemrev.7b00353>
Yamagata University, Yamagata, Japan

This one-stop review covers both the structural aspects of electrochemical flow reactors, as well as selected applications in organic synthesis on various scales and industries. General reactor designs are outlined including divided and undivided microreactors, and serial or parallel electrode configurations. The high surface area-to-volume ratios intrinsic to flow reactors is maximized with interelectrode gaps and flow channels with dimensions of a few micrometers up to 1 mm. Where this technology has penetrated widely in fuel-cell and biotechnology applications, electro-synthetic processes are next in-line for expansion. Electrolyte-free processes are leaner in terms of waste and product isolation strategies, and such approaches are used for a variety of C–C coupling chemistries. Common to the parent discipline of flow chemistry, it is where unstable intermediates are rapidly made-and-consumed that continuous electrochemistries can showcase benefits in yield and selectivity. This is nicely demonstrated with acyliminium intermediates amongst a wide-range of methodologies clearly described.

Author's comments:

"Due to the growing interest in organic electrosynthesis that uses clean electrical energy as a driving force for reactions, research on flow electrosynthesis has continued to make steady progress since the publication of our review. In particular, many synthetic organic chemists dealing with complex organic molecules have recently entered and become active in this field."



Would you like to propose a Flow Chemistry Highlight topic here?

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