Highlights from the Flow Chemistry Literature 2017 (Part 1)

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In this Section of the journal, the literature on continuous flow synthesis (primarily organic synthesis and functional materials) from the period of January to March 2017 is presented. All the publications are listed ordered by journal name, with a Review article appearing at the end. The range of reactions performed in flow and number of multi-step flow synthesis are seen to increase rapidly.

Highlighted Articles

Visible-Light Driven Photocascade Catalysis: Union of *N,N*-Dimethylanilines and α-Azidochalcones in Flow Microreactors
Borra, S.; Chandrasekhar, D.; Adhikary, S.; Rasala, S.; Gokulnath, S.; Maurya, R. A.

The Journal of Organic Chemistry **2017**, *82*, 2249–2256

This group has shown an interesting visible light mediated coupling in flow. While most of the organic compounds do not absorb light in the visible region (390–700 nm), a photocatalyst $Ru(bpy)_3(PF_6)_2$ is used to promote the reaction. *N,N*-Dimethylanilines are coupled with α-azidochalcones using visible-light driven catalyzed photocascade flow synthesis. The approach seems to create one C–C and two C–N new bonds. The reaction involves dual photocatalysis ensuing two sp^3 C–H bond functionalization of *N,N*-dimethylanilines. The approach is demonstrated for the synthesis of 20 different 1,3-diazabicyclo[3.1.0]hexanes in good yields (55–71%).

A High Mobility Reactor Unit for R&D Continuous Flow Transfer Hydrogenations
Jensen, R. K.; Thykier, N.; Enevoldsen, M. V.; Lindhardt, A. T.

Organic Process Research & Development **2017**, *21*, 370–376

After a long time a device suitable for laboratory scale transfer hydrogenations in continuous flow is reported by this group. The setup comprises of cyclohexene and a cosolvent in combination with a palladium-on-charcoal packed bed reactor. Transfer hydrogenation experiments were performed on several functional groups including olefins, triple bonds, nitro-groups, carbonyls, etc. Removal of the protection groups such as Cbz, benzyl, and allyl ether or esters is also reported in high yields. The overall residence time is about 2 min. The authors have also demonstrated two scale-up studies using this approach.

Organic Synthesis

“Continuous Flow Processing of ZIF-8 Membranes on Polymeric Porous Hollow Fiber Supports for CO_2 Capture”
Marti, A. M.; Wickramanayake, W.; Dahe, G.; Sekizkardes, A.; Bank, T. L.; Hopkinson, D. P.; Venna, S. R.
ACS Applied Materials & Interfaces **2017**, *9*, 5678–5682

“Continuous Multistep Synthesis of Perillic Acid from Limonene by Catalytic Biofilms under Segmented Flow”
Willrodt, C.; Halan, B.; Karthaus, L.; Rehdorf, J.; Julsing, M. K.; Buehler, K.; Schmid, A.
Biotechnology and Bioengineering **2017**, *114*, 281–290

“A Catalytic Scalable Pauson–Khand Reaction in a Plug Flow Reactor”
García-Lacuna, J.; Domínguez, G.; Blanco-Urgoiti, J.; Pérez-Castells, J.
Chemical Communications **2017**, *53*, 4014–4017

“Process Intensification of Tetrazole Reaction through Tritylation of 5-[4′-(Methyl) Biphenyl-2-Yl] Using Microreactors”
Maralla, Y.; Sonawane, S.; Kashinath, D.; Pimplapure, M.; Paplal, B.
Chemical Engineering and Processing: Process Intensification **2017**, *112*, 9–17

“Design and Development of Pd-Catalyzed Aerobic *N*-Demethylation Strategies for the Synthesis of Noroxymorphone in Continuous Flow Mode”
Gutmann, B.; Cantillo, D.; Weigl, U.; Cox, D. P.; Kappe, C. O.
European Journal of Organic Chemistry **2017**, *2017*, 914–927

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DOI: 10.1556/1846.2017.22222

"Reaction Process of Resin-Catalyzed Methyl Formate Hydrolysis in Biphasic Continuous Flow"
Reymond, H.; Vitas, S.; Vernuccio, S.; von Rohr, P. R.
Industrial & Engineering Chemistry Research **2017**, *56*, 1439–1449

"Continuous Synthesis of γ-Valerolactone in a Trickle-Bed Reactor over Supported Nickel Catalysts"
Hengst, K.; Ligthart, D. M.; Doronkin, D. E.; Walter, K. M.; Kleist, W.; Hensen, E. J.; Grunwaldt, J.-D.
Industrial & Engineering Chemistry Research **2017**, *56*, 2680–2689

"Application of Polyionic Macromolecules in Micro Flow Syntheses of Nanoparticles"
Visaveliya, N.; Knauer, A.; Köhler, J. M.
Macromolecular Chemistry and Physics **2017**, *218*, 1600371

"Multiphase Flow Reactors for Methanol and Dimethyl Ether Production"
Wang, T.; Wang, J.
Multiphase Reactor Engineering for Clean and Low-Carbon Energy Applications **2017**, 189

"Dichloromethyllithium: Synthesis and Application in Continuous Flow Mode"
Hafner, A.; Mancino, V.; Meisenbach, M.; Schenkel, B.; Sedelmeier, J.
Organic Letters **2017**, *19*, 786–789

"Development of a Commercial Flow Barbier Process for a Pharmaceutical Intermediate"
Braden, T. M.; Johnson, M. D.; Kopach, M. E.; McClary Groh, J.; Spencer, R. D.; Lewis, J.; Heller, M. R.; Schafer, J. P.; Adler, J. J.
Organic Process Research & Development **2017**, *21*, 317–326

"A High Mobility Reactor Unit for R&D Continuous Flow Transfer Hydrogenations"
Jensen, R. K.; Thykier, N.; Enevoldsen, M. V.; Lindhardt, A. T.
Organic Process Research & Development **2017**, *21*, 370–376

"Synthesis of Urea Derivatives in Two Sequential Continuous-Flow Reactors"
Bana, P.; Lakó, Á.; Kiss, N. Z.; Béni, Z.; Szigetvári, Á.; Kóti, J.; Túrós, G. r. I. n.; Éles, J.; Greiner, I.
Organic Process Research & Development **2017**, *21*, 611–622

"A Sensitivity Analysis of a Numbered-up Photomicroreactor System"
Kuijpers, K. P.; van Dijk, M. A.; Rumeur, Q. G.; Hessel, V.; Su, Y.; Noël, T.
Reaction Chemistry & Engineering **2017**, *2*, 109–115

"Continuous Flow Synthesis of Indoles by Pd-Catalyzed Deoxygenation of 2-Nitrostilbenes with Carbon Monoxide"
Glotz, G.; Gutmann, B.; Hanselmann, P.; Kulesza, A.; Roberge, D.; Kappe, C. O.
RSC Advances **2017**, *7*, 10469–10478

"A Chemoselective and Continuous Synthesis of m-Sulfamoylbenzamide Analogues"
Beilstein Verlee, A.; Heugebaert, T.; van der Meer, T.; Kerchev, P. I.; van Breusegem, F.; Stevens, C. V.
The Journal of Organic Chemistry **2017**, *13*, 303

"Visible-Light Driven Photocascade Catalysis: Union of *N,N*-Dimethylanilines and α-Azidochalcones in Flow Microreactors"
Borra, S.; Chandrasekhar, D.; Adhikary, S.; Rasala, S.; Gokulnath, S.; Maurya, R. A.
The Journal of Organic Chemistry **2017**, *82*, 2249–2256

Nanomaterials

"High-Throughput Continuous Hydrothermal Synthesis of Transparent Conducting Aluminum and Gallium Co-Doped Zinc Oxides"
Howard, D. P.; Marchand, P.; McCafferty, L.; Carmalt, C. J.; Parkin, I. P.; Darr, J. A.
ACS Combinatorial Science **2017**, *19*, 239–245

"Heterogeneous Nucleation and Surface Conformal Growth of Silver Nanocoatings on Colloidal Silica in a Continuous Flow Static T-Mixer"
Meincke, T.; Bao, H.; Pflug, L.; Stingl, M.; Taylor, R. N. K.
Chemical Engineering Journal **2017**, *308*, 89–100

"A Novel Approach for Continuous Synthesis of Calcium Carbonate Using Sequential Operation of Two Sonochemical Reactors"
Shirsath, S.; Bhanvase, B.; Sonawane, S.; Gogate, P.; Pandit, A.
Ultrasonics Sonochemistry **2017**, *35*, 124–133

Review

"Contribution of Microreactor Technology and Flow Chemistry to the Development of Green and Sustainable Synthesis"
Fanelli, F.; Parisi, G.; Degennaro, L.; Luisi, R.
Beilstein Journal of Organic Chemistry **2017**, *13*, 520