Institute of Chemical Engineering

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Laboratory of Functional Materials and Microreactors

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Current research activities

Engineering of monolithic microreactors for continuous catalytic processes

The research focuses on microreactors based on silica monoliths with a precisely engineered porous architecture, featuring a continuous network of transport macropores (10–100 μm) and an extensive mesopore system. A key feature of these materials is their low flow resistance. Moreover, the tortuous macropore structure of the monoliths significantly enhances mass and heat transfer compared with conventional microreactors based on straight channels. The high specific surface area of silica enables the design of catalytic properties by controlling the introduction of active centers with the desired concentration and uniform distribution. Active sites may also be incorporated during monolith synthesis. The objective of the research is to develop novel catalytic systems, to examine the effects of different types of active sites and their mutual interactions in sequential chemical reactions—including those proceeding via domino pathways—and to intensify the conversion of substrates into complex chemical compounds. The results obtained to date include the development of a wide range of microreactors incorporating acidic, basic, oxidative, reductive, and

bifunctional active sites. The high efficiency and selectivity of the proposed systems have been demonstrated in esterification reactions, selective oxidation of organic compounds, Meerwein–Ponndorf–Verley reduction, Knoevenagel condensation, and tandem deacetalization–Knoevenagel condensation processes. An important aspect of the ongoing research is the investigation of microreactor hydrodynamics.

Metryczka

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