

催化、动力学与反应器

## 微反应器内甲苯气固催化氧化反应动力学

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摘要

微通道反应器具有优良的传热、传质性能,能有效避免催化剂床层内热点的形成,为研究强放热反应动力学提供有利条件。开展了微反应器内的V2O5/TiO2催化剂上的甲苯气相选择氧化动力学研究,在简化反应网络的基础上建立了动力学模型,并给出动力学参数。该模型能较好地反映和预测较宽的反应条件范围内的甲苯气固相催化氧化反应转化率及产物分布,为优化操作条件提供依据。

关键词

[甲苯](#) [选择性氧化](#) [气相催化](#) [V/Ti氧化物](#) [微反应器](#) [动力学](#)

分类号

## Kinetics of the gas phase catalytic oxidation of toluene in a microreactor

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### Abstract

In this work, the kinetics of gas phase selective oxidation of toluene to benzaldehyde (BA) and benzoic acid (BAc) over V2O5/TiO2 catalyst was studied in a microchannel reactor. With the elimination of the mass and heat transfer limitations, the intrinsic characteristics of the reactions were well investigated in the microreactor. It was found that the activity of the catalyst decreased within the first three hours and after that no deactivation occurred during the experiments. The kinetic experiments were carried out in the steady state of the catalyst. A reaction network including five reactions was proposed, i.e. the consecutive oxidation of toluene to BA, BA to BAc, and the deep oxidation of all of the three to COx. It was assumed that the reactions were first order dependent on the organic compounds and the kinetic parameters were evaluated by the integral reactor model. The rate constants at a specific temperature, the pre-exponential factors and the activation energies of all the reaction steps were estimated. A simple and practicable kinetic model was built to characterize the process and to pre-estimate the rate of toluene oxidation and the product distribution within a rather wide reaction condition range.

### Key words

[toluene](#) [selective oxidation](#) [gas phase catalytic reaction](#) [V/Ti oxide](#) [microreactor](#) [kinetics](#)

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