

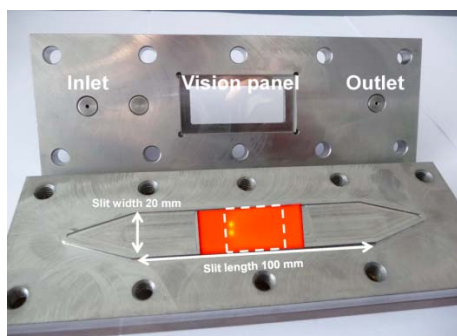
# UniCat Seminar

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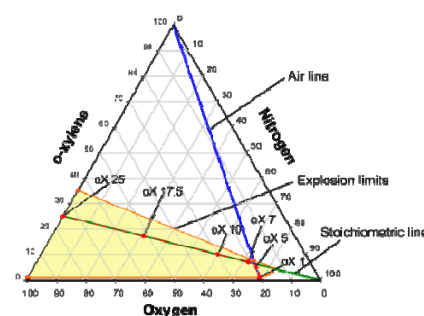
Lecturer: **Prof. Dr.-Ing. Elias Klemm**, Institute of Chemical Technology, Faculty of Chemistry, University of Stuttgart, Germany

Title: **Heterogeneously Catalyzed Partial Oxidations in the Explosion Regime using Microreactors**

Abstract: Heterogeneously catalyzed partial oxidations in the gas phase are an important class of reactions that are usually carried out below the lower or above the upper explosion limit in order to avoid thermal and chain explosions. Due to their high surface-to-volume ratio microreactors allow the suppression of both thermal and chain explosions. However, microreactors are not inherently safe, but nevertheless they allow a significant expansion of the safe operation window depending on reaction conditions and the reactor dimensions chosen. In the safety engineering part of the project, performed at the Federal Institute of Materials Research and Testing in Berlin (BAM), these dependencies have been investigated and in the chemical reaction engineering part of the project, performed at University of Stuttgart, opportunities and limitations for the application in chemical industry are exploited. Safe operation inside the explosion regime and a strong process intensification could be demonstrated, but even for catalyst coatings and micro fixed beds hotspots can occur (see figure below) which cause a sharp drop of the selectivity of the partial oxidation products.



Figures: left: Hotspot formation monitored with IR camera (area coated with catalyst marked by dashed rectangular, coating thickness 500  $\mu\text{m}$ , Feed Composition  $\text{oX}10$ ). right: Feed compositions investigated.



#### Literature

- T. Lange, S. Heinrich, C. Liebner, H. Hieronymus, E. Klemm, *Reaction engineering investigations of the heterogeneously catalyzed partial oxidation of o-xylene in the explosion regime using a micro fixed bed reactor*, Chem. Eng. Sci., **2012**, 69, 440–448.
- S. Heinrich, F. Edeling, C. Liebner, H. Hieronymus, T. Lange, E. Klemm, *Catalyst as ignition source of an explosion inside a microreactor*, Chem. Eng. Sci., **2012**, 84, 540–543.
- C. Liebner, J. Fischer, S. Heinrich, H. Hieronymus, E. Klemm, *Are Micro Reactors Inherently Safe? – An Investigation of Gas Phase Explosion Propagation Limits on ethylene mixtures*, Process Safety and Environmental Protection, **2012**, 90, 77–82.
- H. Hieronymus, J. Fischer, S. Heinrich, C. Liebner, T. Lange, E. Klemm, *Sicherheitstechnische Untersuchungen zum Betrieb von Mikroreaktoren im Explosionsbereich*, Chem. Ing. Tech. **2011**, 83, No. 10, 1742–1747.

Date: **Tuesday, May 21<sup>st</sup>, 2013 at 4:00 pm**

Location: **TU Berlin, Gerhard Ertl Center, Marchstr. 6  
10587 Berlin, Building BEL, Meeting Room BEL 301**

Organizer: **Prof. Reinhard Schomäcker (TUB)**

Coffee and tea will be served thirty minutes prior to the lecture start.

**Guests are cordially invited to attend!**

Prof. Matthias Driess, Chair of the Cluster of Excellence UniCat