



Microwave Accelerated Heterogeneous Catalysis – Flow-Through Reactor Concept And Application



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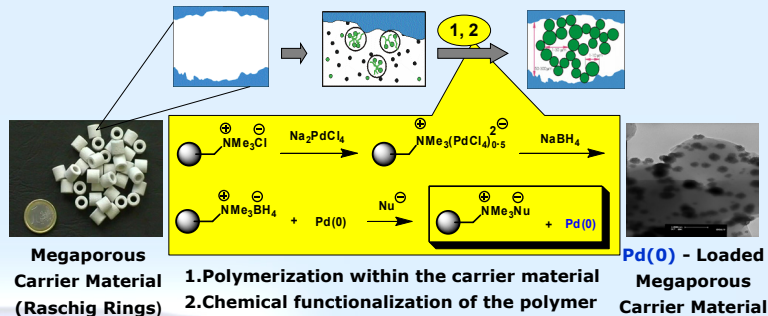
1 Introduction

Flow-through processes^[1] in organic synthesis become more important as an enabling technology for a cost effective, save and convenient method. This requires appropriate reactors with functionalities for organic reactions. In this project noble metal-loaded polymer/carrier reactors^[2] able to be operated in a microwave field^[3] were investigated.

By application of a microwave field metal sites are heated whereas the polymer/carrier material remains transparent to irradiation. This may lead to hot-spots with higher reactivity which contribute to a more efficient heating and thus to the higher observed reaction rates. Initial results on catalyst preparation and characterization as well as investigations on the microwave heating process are in exploration. The field of application covers Pd-catalyzed transfer hydrogenations as well as C-C coupling reactions.

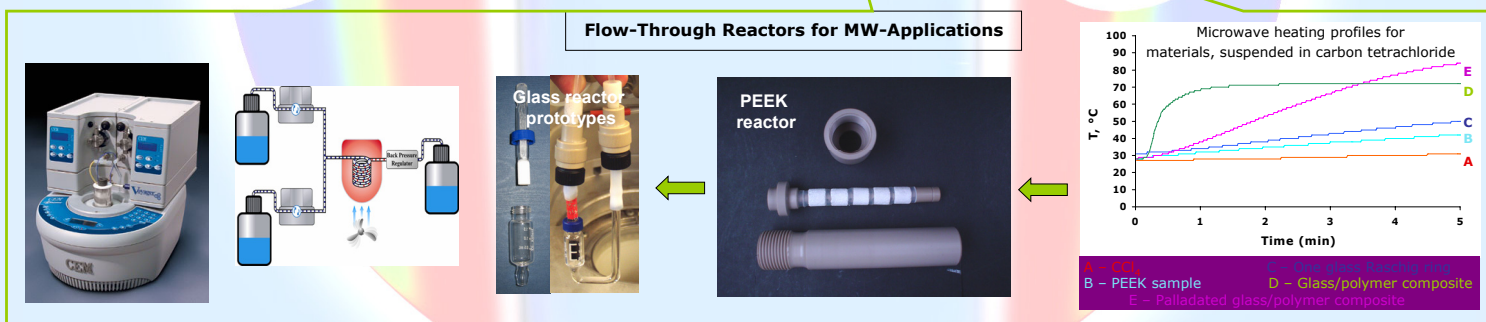
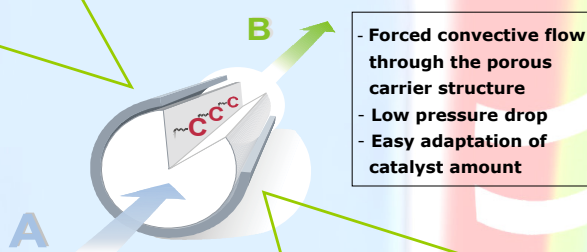
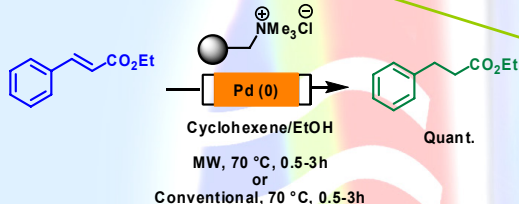
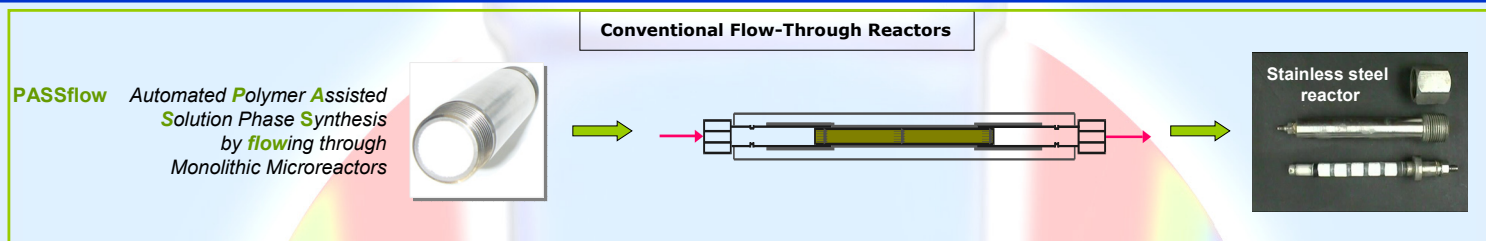
[1] Kirschning, A. et al. *Angew. Chem. Int. Ed.* **2001**, *40*, 3995. [2] Schonfeld, H.; Hunger, K.; Cecilia, R.; Kunz, U. *Chem. Eng. J.* **2004**, *101*, 455. [3] Kappe, C. O. *Angew. Chem., Int. Ed.* **2004**, *43*, 6250.

2 Heterogeneous Catalyst Preparation^[4]



[4] Solodenko, W. et al. *Eur. J. Org. Chem.*, **2004**, 3601

3 Flow-Trough Reactor - Concept and Application



The selected reactor design allows selective heating of the strongly microwave absorbing palladium nanoparticles by microwave energy, since both the chosen reactor materials as well as the porous glass polymer composite raschig rings are microwave transparent. An extensive set of microwave irradiation experiments with all the materials used in the reactor construction were performed, confirming the difference in the microwave absorbance of the various composite materials when suspended in a microwave transparent solvent such as carbon tetrachloride.

[5] Kirschning, A.; Solodenko, W.; Mennecke, K. *Chem. Eur. J.* **2006**, *12*, 5927 and citations therein. [6] Glasnov, T.; Kappe, C. O. et al., unpublished results

4 Conclusion

- Successful development of **novel polymer/carrier composites** and **monolithic reactors**
- **Versatile tool** for different polymer-supported applications
- **Reduction of costs and laboratory time**
- **Easy automation** using standard laboratory equipment

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