



Université Blaise Pascal

UNIVERSITÉ BLAISE PASCAL  
U.F.R de Recherche Scientifique et Technique



## CYCLE DE CONFÉRENCES DE CHIMIE

Avec le concours de : *Manufacture Française des Pneumatiques MICHELIN*  
*Centre de Développement Préclinique, Schering-Plough*  
*Fédération de Chimie (FR 2404)*  
*Section Auvergne de la Société Française de Chimie*  
*U.F.R.S.T. / Master de Chimie / Département de Chimie*

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**Mercredi 9 Juin 2010 à 16 h**

**Amphi de Chimie Paul REMI - (Site des Cézeaux)**

**Pr Volker Hessel**

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### **Micro Process Technology and Novel Process Windows - Gateways to Sustainable Chemical Production -**

#### **Micro Process Technology**

Draw on sustainability for chemical production processes demands the integration of sustainability aspects already during process development, whereas further environmental impacts and production costs become predefined. Micro and milli process technologies can provide novel ways for process intensification combined with ecological and economic advantages and first assessments were made here, mainly by industry. Micro process technology and process intensification are breakthrough technologies with step-change nature, but address a traditional industry used to incremental changes. Microstructured reactors have entered the field of fine chemistry with first pilot and production plants; some examples being reported. A manifold offer for microreactors, micro heat exchangers, micromixers and related equipment is on hand. Scaled-out microstructured reactors were run in demonstration pilot plants using standard lab peripherals in short performance trials; often at industrial site. feasibility in fine chemistry has been reported for several pilot demonstration runs, but the picture on the use for business is still somewhat vague and scattered. The micro-reactor based pilot plants in the past were dedicated and home-made; just recently some commercial modular plants with standardised, multigenerational microreactors have been launched.

#### **Novel Process Windows**

Micro Process Technology speeds up heat and mass transfer; Novel Process Windows speed up reaction kinetics. Microreactors are apparatus made for millisecond- and second-processing - the question is whether there is any means to speed up chemistry for a better fit to the new PI apparatus. A hand-in-hand design of the reactors and processes is demanded to enable chemistry rather than subduing chemistry around the reactor. Often the process windows suited for microprocessing are very different and remote from the classical process sheets - shifted to harsher conditions for process intensification (higher temperature, higher pressure, higher concentration/solvent-free, explosive or thermal runaway regime) and utilizing process integration in time and space (all-at-once, direct route, one flow-multi-step, transform to catalytic) - named here Novel Process Windows. Via intensification, space-time yields and the productivity of the reactor can be increased by orders of magnitude and other dramatic performance step changes can be achieved. The integration of reaction and processing steps gives room for new chemical transformations. The impact does not exclusively apply to sole speeding up of chemistry, but also to the creation of new and better functional materials.

[1] V. Hessel Novel Process Windows, Chem. Eng. Technol. 32, 11 (2009) 1655–1681.

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