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FRAUNHOFER INSTITUTE FOR MICROELECTRONIC CIRCUITS AND SYSTEMS IMS

1 *Micro reaction system, including a robot, the syringe pumps, integrated electronics and the software*

MICRO REACTORS

• SMALLER DEVICES FOR EXPANDING MARKETS
• ENVIRONMENT FRIENDLY
• INHERENT SAFE

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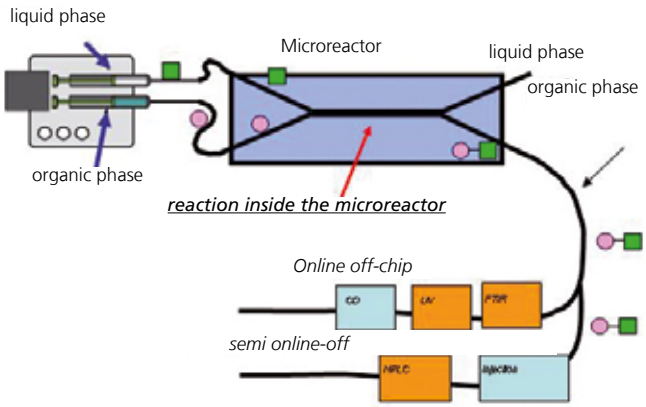
Introduction

Since the production of bulk chemicals moved more and more away from the industrial countries, it is very important for our chemical industry to search for high priced products and methods to produce them. One technology to realize such products, which was developed in the past years in universities and research institutes, is micro reaction technology. With this technology you are able to produce pure, high qualitative, high priced and new chemicals. In a cooperative Euregio project between the Fraunhofer IMS, the Radboud university Nijmegen and Wageningen university these partners developed a modular and innovative micro reaction system. The system includes the reactors, the syringe pumps to bring in the chemicals, the integrated electronics and the software to control and vary the reaction parameters via a personal computer. Because of the close cooperation between chemical engineering and modern electronics we achieved the aim to create an extreme compact, tough and easy to handle micro reactor system.



Technology

The heart of a micro reactor system is a glass plate in which channels between 50-150 µm width are corroded. The structure of the channels can be adapted very easily to the chemical needs. We are able to realize reactors with very short or long stay time, symmetric or asymmetric channels, for different amounts of substances and with two or more compounds. An IP protected chip holder takes the glass plate and is the link to the syringe pumps via micro tubes. The holder even couples with the sensors and actors, which grant precise warming and cooling and to vary the flow through ratio. The real-time and security relevant control commands are processed in a control box with a 8 bit µC. This concept ensures through the programming of the µC, greatest possible security for example against overheating. This gives us the opportunity to carry out even temperature critical reactions with the micro reactor. The control box can be used with a USB 2.0 interface on a computer.

Application range

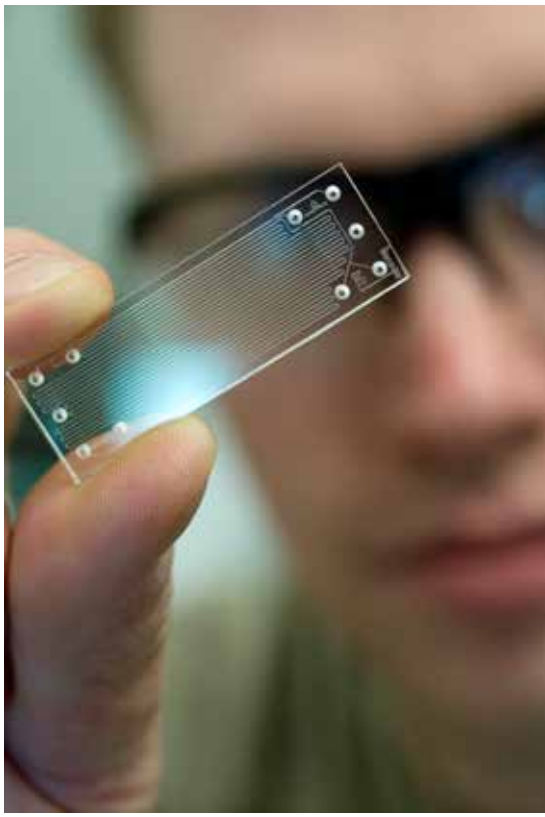
There a many possible applications because of the broad range of varying parameters:
Flow through rates: nl/min - µl/min
Temperature range: -5°C – +80°C
Chemicals: fluid chemicals
Number of chemical components:
2 or more
Micro reactors can also be cascaded and used in batch processes.

Advantage of our micro reactor system

Compared with conventional reactors is this type of micro reactor more advantageous:

1. Effective heat exchange which allows you to handle fast and even extreme exothermic reactions
2. Fast and intensive mixing of fluid ingredients, but it is also possible to nearly avoid a mixture of the substances
3. Very high security because of the software and the circumstance that only a small amount of chemicals is processed per time unit
4. Precise control of process parameters
5. Higher efficiency and smaller amount of waste
6. High flexibility in construction of the microreactors because of customized design
7. Fast change of process parameters and the possibility to examine a lot of chemicals in a row and to analyse a mass of new chemical combinations
8. Economical use of expensive chemicals like enzymes, catalysts which grants a saving of money

The micro reactor project was subsidised by EU-Program INTERREG IIIA, the Euregio Rhein-Waal and by the ministries of economy of the Netherlands and North Rhine/ Westphalia.



2 *Sensors and actors, which grant precise warming and cooling*
3 *Diagram of a chemical process*
4 *Micro reactor comprising a glass plate with channels between 50-150 µm*