

Microwave miniaturized reactor

Nowadays, in many cases, the contribution of microwaves to chemistry is well known, especially in batch mode. The main advantages are the heating of the core volume, the increase in chemical reaction rate and selectivity. However, this type of heating is limited to chemical systems whose dielectric properties are compatible for good interaction with waves. Combining continuous miniaturized reactor, microwave heating and heating properties of the reactor material, could open up new possibilities in carrying out chemical reaction. The ceramic reactor allows a fast thermal dynamics thanks to the interaction of the microwaves with the material itself allowing a very fast heating and high temperatures of any chemical medium, even microwave transparent.

DESCRIPTION*

- The reactor eliminates the need for wave-matter coupling, which sometimes hinders the development of microwave chemistry, as each chemical system has its own dielectric properties
- Its characteristics are:
 - Microstructured continuous reactor
 - Microwave heating
 - High performance ceramic
 - Response independent of the nature of the reaction media
 - Rapid heat diffusion in all the reaction media
- Proof of concept based on the following model reactions:

Diesterification of succinic acid with ethanol			
T = 120 °C	P = 20 bar	t = 1 min MW	Yield = 70%
T = 100 °C	P = 20 bar	t = 5 min MW	Yield = 99%

Esterification of acetic acid with methanol			
T = 120 °C	P = 6 bar	t = 6 s MW	Yield = 62%
T = 60 °C	P = 1 bar	t = 300 s MW	Yield = 70%

TECHNICAL SPECIFICATIONS

Material	Silicon Carbide
Residence time	From several seconds to several minutes

*Technology requiring license rights.

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COMPETITIVE ADVANTAGES

- Very fast temperature rise
- Temperature > 300°C
- Pressure up to 30 bar
- Activation independent of the reaction media
- Perfect control of the temperature during the process
- Fast system response time
- New ways for « flow chemistry »
- Avoid the use of heat transfer fluid
- Control/command system available

APPLICATIONS

- Chemical reactions at high temperature, under pressure
- Corrosive chemical reaction

INTELLECTUAL PROPERTY

- Patent application filed

DEVELOPMENT STAGE

- Technology validated at lab level
- 1 2 3 **4** 5 6 7 8 9
- Pilot scale available at the laboratory

LABORATORY

- Laboratory of Chemical Engineering University of Toulouse - France



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