Funding scheme: FP7-NMP-2010-LARGE-4
Grant Agreement: N° 263007

TECHNOLOGY OFFER:
NOVEL ZEOLITE MEMBRANES OF TYPE SOD FOR H_2O SEPARATION

OVERVIEW

Category: Membrane ☑, Catalyst ☐, Reactor ☑, Process ☐, R&D knowledge ☑, Other ☐

Benefit summary: A thin-layer zeolite SOD membrane on a porous ceramic support can remove water under harsh conditions such as high temperatures (200-300 °C) and elevated pressure (up to 20 bar). No organic membrane can withstand such conditions. This SOD membrane can be used especially to remove water from chemical reactions under equilibrium-controlled conditions.

Development status: Discs of 2 cm diameter are available, first scale up experiments show that it is possible to grow the SOD layer on tubular ceramic supports.

IP status: No patents, but numerous published papers.

NOVELTY

- **Technology benefit description**: By using SOD membranes as a supported thin layer on porous alumnina supports, water can be removed from chemical reactors under in situ conditions und chemical reaction conditions (elevated temperatures and pressure). Examples are: Water removal from Fischer Tropsch reaction, from dimethylcarbonate reaction, from dimethylether reaction, from oxidative dehydrogenation, from oxidative methane coupling, from oxidative methane aromatization….
- **Technology uniqueness and comparison vs state-of-the-art**: There exist numerous hydrophilic organic membranes but they cannot be used (i) at elevated temperatures, and (ii) they swell or even decompose in contact with organic solvents. There exist also first hydrophilic zeolite membranes of type LTA but these membrane are hydrothermally not stable, i.e. the LTA zeolite layer decomposes in contact with steam and liquid water at temperatures > 170 °C. Zeolite SOD is a more dense structure compared with LTA, and therefore, it is more stable at high temperatures.

DEVELOPMENT

- **Technology Readiness Level**: TRL 1 ☐; 2 ☐; 3 ☐; 4 ☐; 5 ☐; 6 ☐; 7 ☐; 8 ☐; 9 ☐
- **Development status**: Tubular porous alumina discs of 2 cm diameter are available. These discs have been tested under lab conditions up to 200 °C. First scale up experiments show that it is possible to grow the SOD layer on tubular ceramic supports such as 1 cm porous ceramic tubes, or 1 mm hollow fibers.

INTELLECTUAL PROPERTY

Patent / application N°	Title	Countries	Status	Priority date
No patents				

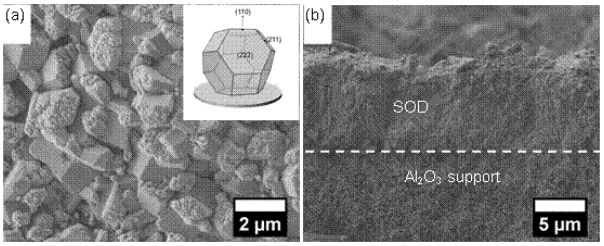
TECHNOLOGY PROVIDER

- **Technology provided by**: Leibniz University Hannover, institute of Physical Chemistry and Electrochemistry, contact person J. Caro…
- **Related expertise**: J. Caro has published more than 200 papers on membranes and membrane reactors.

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 263007.

TECHNICAL DETAILS

- **Description**: As described in the publications (see below), a 5 – 10 µm thick SOD layer can be crystallized on the porous alumina support. This SOD is the hydrophilic top layer which separates water or steam from liquids and gases.



N. Wang, Y. Liu, A. Huang, J. Caro, *Supported SOD membrane with steam selectivity by a two-step repeated hydrothermal synthesis,* Micropor. Mesopor. Mater. 192 (2014) 8-13.

N. Wang, Y. Liu, A. Huang, J. Caro, *Hydrophilic SOD and LTA membranes for membrane-supported methanol, dimethylether and dimethylcarbonate synthesis*. Micropor. Mesopor. Mater. 207 (2015) 33-38.

LICENSING

- **Collaboration type sought**: Scale up, pilot testing
- **Support provided**: Tests under lab conditions up to 5 bar and 200 °C.

CONTACT DETAILS

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