

SEMINAR SERIES

HIGHLIGHTS IN ENERGY RESEARCH

20.09.2018, 16:00 - 17:00, EPFL Valais, 4th floor, ZEUIZER room

Smart membranes: Perovskite, zeolite, MOF, COF, MXene materials in gas separation and membrane reactors

Prof. Dr. Jürgen Caro

*Institute of Physical Chemistry and Electrochemistry,
Gottfried Wilhelm Leibniz Universität Hannover, Germany*

Host : Prof. Kumar Agrawal

Caro starts with some novel preparation techniques for supported MOF membranes. Supported thin MOF layers are usually prepared by solvothermal crystallization. Also counter diffusion and interfacial growth, chemical vapor deposition, electrophoretic nuclei assembly, pseudomorphic replication or phase transformation, and layer-by-layer (l-b-l) techniques by dipping/spraying can be used. Recent developments in gas separation membranes such as switching of gas transport by external stimuli like electric fields [1] or light of a certain wavelength [2] are highlighted.

A new field of membrane research is the deposition of 2D nano-sheets to stacked membranes. Recent examples are synthesis of MXene (Ti_3AlC_2) [3,4] and g- C_3N_4 [5] membranes with synthesis of the nano-sheets from the 3D materials (top down). New COF membranes allow high water flux and good dye/drug retention [6].

Membranes can be used in membrane reactors for process intensification. One example is the formation of dimethylether (DME) from methanol (MeOH) according to $2 \text{MeOH} \rightleftharpoons \text{DME} + \text{H}_2\text{O}$. The product water was removed through a hydrophilic LTA membrane [7]. A second example is to support the aromatization of methane by using oxygen or proton conducting membranes. Proton conducting ceramics can shift the equilibrium $6 \text{CH}_4 \rightleftharpoons \text{C}_6\text{H}_6 + 9 \text{H}_2$ by extracting hydrogen [8]. Oxygen transporting membranes can influence the reaction by the in situ combustion of hydrogen $6 \text{CH}_4 + 4,5 \text{O}_2 \rightarrow \text{C}_6\text{H}_6 + 9 \text{H}_2\text{O}$ [9].

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École polytechnique fédérale de Lausanne (EPFL) Valais/Wallis
Institute of Chemical Sciences and Engineering (ISIC)
Basic Science Faculty (SB)
Energypolis, Rue de l'Industrie 17, CH-1950 Sion, Switzerland



Prof. Dr. Jürgen Caro studied chemistry and obtained PhD at Leipzig University in 1977. Since 2001 he has been the chair of Physical Chemistry at Hannover University. J. Caro is author of about 350 publications and 42 patents. He has been visiting professor at the Chinese Academy of Sciences in Ningbo and Guest Professor at the Dalian University of Technology. In 2013, together with M. Tsapatsis, he received the Breck Award of the International Zeolite Association and also Ostwald Medal of the Saxon Academy of Sciences. In 2016, J. Caro became Corresponding Member of the Saxon Academy of Sciences and in 2017, 1000 Talents Professor at the South China University of Technology in Guangzhou. J. Caro is speaker of the Hannover branch of Society of German Chemists