DEPARTMENTAL SEMINAR

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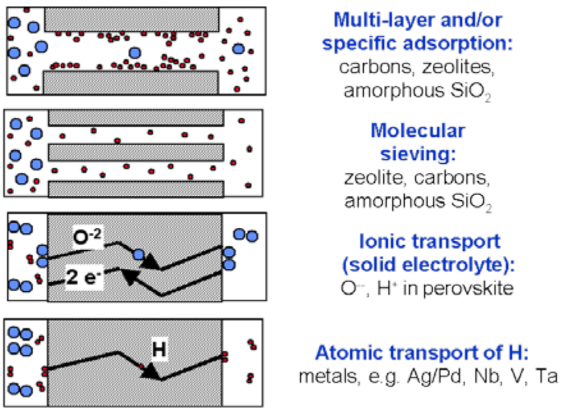
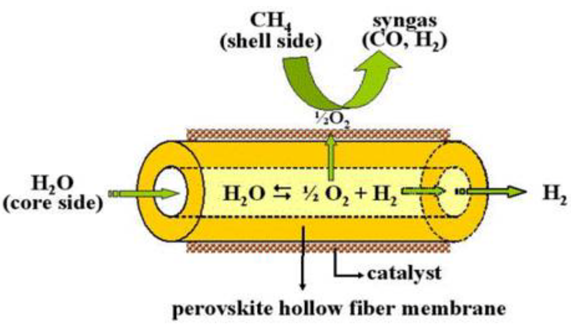
TOPIC	**New Inorganic Membranes for Hydrogen Production**
SPEAKER	**Prof J. Caro**
HOST	**Prof Hong Liang**
DATE	**23rd February 2009 (Monday)**
TIME	**3pm**
VENUE	**E5-03-19 , Faculty of Engineering, National University of Singapore NUS Campus Map & NUS: Faculty of Engineering**

SYNOPSIS

Metal, ceramic and carbon porous membranes have been investigated for hydrogen separation. However, porous membranes such as zeolite, sol-gel and carbon have gained popularity in research community in recent years due to their narrow pore size distribution. This unique characteristic allows small molecules such as H_2, H_2O or NH_3 to be separated easily. The schematic diagram on the right illustrates the different separation mechanisms of inorganic membranes.





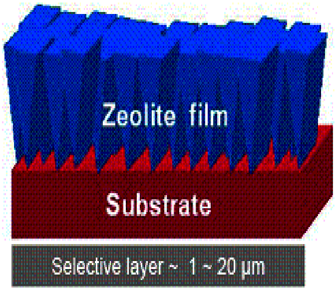
H.Q. Jiang, H.H. Wang, S. Werth, T. Schiestel, J. Caro, *Angew. Chem.* **2008**, *47*, 9341-9344.

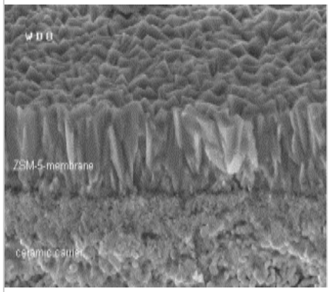
The diagram on the left shows a membrane reactor where hydrogen is produced by using an oxygen transporting membrane. At high temperatures, water undergoes self-dissociation

$$H_2O \leftrightarrows H_2 + ½\ O_2$$

If the oxygen is removed sufficiently fast via a perovskite membrane, a mixture of non-reacted water and hydrogen can be obtained in the core side. The water is removed by condensation and a production rate of > $1m^3$ (STP) H_2/m^2 h is found. To reduce the oxygen partial pressure on the shell side, oxygen is consumed by the partial oxidation of methane to form synthesis gas according to $CH_4 + ½ O_2 \rightarrow 2 H_2 + CO$. The products of this reaction can be transformed into methanol or Fischer Tropsch products (e.g. Diesel).

ZSM-5/silicalite membrane is obtained by crystallization of a zeolite layer on a titania support. These membranes show a hydrogen-selectivity of 70 with fluxes of about 1 m^3 (STP) H_2/m^2 h. In this work, Pd-based metal and supported thin carbon membranes are used as a benchmark for comparison.





BIOGRAPHY

J. Caro is a full professor and the director of the Institute of Physical Chemistry and Electrochemistry at the University of Hannover since 2001. He served as the President of the German Catalysis Society in 2005 and 2006. He is also a member of the Board of Directors of the German Membrane Society and a speaker of the Lighthouse Project for the German Research Ministry (with 12 partners from industry and academic community). Prof Caro has published over 190 papers and is currently having 38 patents under his name. He is also a member of the Editorial Boards of 5 established journals, including Advanced Materials, Micropor. Mesopor. Materials and Catalysis Communications.

A L L   A R E   W E L C O M E

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