

Title **H₂ permselective silica membranes prepared by chemical vapor deposition(CVD) and their application for membrane reactor**

Speaker **Prof. Shin-ichi Nakao**
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Place **I²CNER Hall, Ito campus, Kyushu University**

Abstract

Hydrogen is a promising clean energy and produced from fossil energy and renewable energy, and safe transportation and storage of H₂ are difficult. Amorphous silica membranes have excellent H₂ permeance and selectivity, and membrane reactors with the high performance membranes obtained are promising technology to produce H₂.

Silica membranes can be prepared by CVD, and the membrane performance is determined by silica precursors used. Many types of precursors have been already tested and the membranes obtained showed excellent H₂ permeance and selectivity against larger gas molecules. The membranes also showed good hydrothermal stability and long term stability.

Hydrogen production reactions are equilibrium reactions. Thus extracting H₂ from reaction site can shift equilibrium and promote H₂ production. To do this, membrane reactors have been applied for methane steam reforming, thermal decomposition of hydrogen sulfide and dehydrogenation of cyclohexane and methylcyclohexane (MCH). In all cases the conversions obtained by membrane reactors were very much higher than those determined by thermodynamics.

The most possible H₂ carrier could be organic chemical hydrides, such as methylcyclohexane (MCH)/toluene (TOL). The membrane reactor to dehydrogenate MCH is key technology. The membranes prepared by CVD showed excellent selectivity of H₂ over MCH and TOL, and greatly high permeance of H₂. The stabilities of the membranes have been tested for long term, and the good stability was demonstrated.

About the Speaker

Dr. Shin-ichi Nakao graduated the Univ. of Tokyo in Chem. Eng. Dept. in 1976 and received his Ph. D. in 1981. He started to work at the same university, and he became Professor in 1995. In 2009 he moved to Kogakuin University and he became Professor emeritus of the University of Tokyo in 2011. He is also working in Research Institute of Innovative Technology for the Earth(RITE) from 2012. He has worked on the membrane science and technology for 40 years. His current interests are transport phenomena on RO, NF, UF and MF, water treatment with membranes especially MBR, synthesis of silica membranes for H₂ permeation by CVD and membrane reactors.”

Host: Associate Professor Ikuo Taniguchi

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