**407c Silica and Silica-Metal Membranes for Hydrogen Separation and Membrane Reactors**

*Yasushi Yoshino, Balagopal N. Nair, Hisatomi Taguchi, and Naotsugu Itoh*

Steam methane-reforming accounts for bulk of the hydrogen produced in the world today. This reaction is equilibrium limited and efficiency of the reaction is not very high unless the temperature is set extremely high. It is well known that selective separation of hydrogen from the reactor environment using membranes could make the reforming process more efficient. One of the major candidates for such selective hydrogen removal from reactor environment is microporous membrane based on silica. Silica membranes could be processed with active pore sizes smaller than the sizes of gas molecules such as CO and CH4 and therefore successful separation of hydrogen from these molecules could be carried out using silica membranes.

Silica membranes and silica-metal composite membranes were developed in our laboratory following sol-gel protocols. Silica sols were prepared by the hydrolysis of tetra-ethyl-ortho-silicate in the presence of HNO3 acid catalyst. Acid catalyst was added into the alkoxide in the first step. Metallic precursors were added in a second step into the hydrolysed and partial condensed alkoxide. These sols were dip coated on porous alumina supports to make asymmetric microporous membranes. These membranes showed H2/N2 ideal selectivity values over 100 and H2 permeation values higher than 10-6 mol/m2.s.Pa at 873K. Silica-metal membranes showed better thermal stability behaviour compared to silica membranes. Current research results including data on high temperature permeation and separation of the membranes will be reported in the presentation

This work was performed as a part of the R&D Project for High Efficiency Hydrogen Production/Separation System using Ceramic Membrane funded by NEDO, Japan.

Keywords: silica membranes, composites, membrane reactors, hydrogen production