USC Viterbi
School of Engineering

MORK FAMILY DEPARTMENT OF CHEMICAL ENGINEERING AND MATERIALS SCIENCE

Lyman Handy Colloquium

Thursday, Dec. 5, 2013
ZHS 159 @ 12:45 PM

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Composite Pd-based Hydrogen Separation Membranes – From Laboratory to Commercialization

Abstract: Developing technologies which can economically produce hydrogen with CO2 at high pressures suitable for sequestration is of great importance to the hydrogen production and to protecting our environment. Pd-based membrane separators and reactors can satisfy both requirements. We have devoted considerable effort to develop Pd based hydrogen separator and WGS (water gas shift) catalytic membrane reactor for IGCC (Integrated gasification combined cycle) and steam reforming applications and have been studying the characteristics and stability of composite Pd based membranes not only in the laboratory but also in actual coal derived syngas atmospheres at the US Department of Energy sponsored National Carbon Capture Center (NCCC) in Wilsonville, Alabama.

This presentation will provide an overview of the basis of composite Pd and Pd/alloy membranes for hydrogen separations with a special emphasis on the method of electroless plating for the membrane preparation. In addition, the fundamental studies carried out in our laboratory on membrane synthesis, characterization and long-term membrane stability of Pd and Pd/alloy membranes supported on porous stainless steel (PSS) will be presented. The concept we developed for improving the long-term thermal stability of composite Pd and Pd/alloy PSS membranes by the controlled in-situ oxidation of the PSS substrate to create an intermetallic diffusion barrier layer in conjunction with pore grading technique will be described. In addition, the field tests results obtained at NCCC using syngas from an actual coal gasifier showed that high H2 purity in excess of 99.89% could be achieved for over 200 h in the syngas at 12.6 bar and 450° C, representing significant advancement and breakthrough results, never reported before in the pertinent literature for the application of composite Pd membranes for H2 production from coal gas.

The presentation will conclude with a brief discussion on the perspective of the commercialization of the technology.

The scientific community is cordially invited.