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Evaluation of Pd-based Membrane Fabricated by Surfactant Induced Electroless Plating (SIEP)

By

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Pd-based membrane has tremendous potential in hydrogen separation and purification at elevated temperature. In our laboratory, we are working on the development and application of palladium and palladium-alloy thin film composite membranes in membrane reactor-separator configuration for simultaneous production and separation for hydrogen from reforming reactions. Fabrication of defect free thin Pd-film with high flux is a technical challenge. Usually Pd-membranes on microporous stainless steel (MPSS) support are fabricated by electroless plating process which involve activation and sensitization of the support surface and followed by autocatalytic Pd-deposition in electroless plating bath. In the conventional electroless plating, inhomogeneous Pd-deposition is a major problem that results in poor membrane morphology. In our study, it was identified that the gas bubbles (ammonia and nitrogen) that released due to autocatalytic reactions tend to adhere to the substrate surface and result in poor Pd-deposition. Incorporation of cationic surface active agents with favorable structures into the plating bath appears to be a promising remedy. More importantly, suitable cationic charge and concentration would be useful to tailor the Pd-grain size and subsequent agglomeration. The surface morphology and compositional microstructures were examined using SEM coupled with in-situ EDS (Energy Dispersive Spectroscopy). The Pd-MPSS membranes were fabricated by this surfactant induced electroless plating (SIEP) method and were tested for H_2-perm-selectivity. To demonstrate the application of the Pd-MPSS membrane, steam methanol reforming (SMR) was carried out in a Pd-based membrane reactor fabricated by SIEP method. Experimental results along with modeling work revealed that the Pd-based membrane reactor was superior to conventional non-membrane reforming reactors with respect to conversion, selectivity and hydrogen productivity. In this presentation, we will discuss our ongoing research on H_2-separtion membranes for high temperature applications.

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