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Fabrication and characterization of Pd-Ni porous membrane for hydrogen separation

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We demonstrate for the first time the fabrication of ultrathin palladium membrane on porous nickel rod type support with mechanical treatment for H_2 separation. Porous nickel membrane has so small and uniform pore size to be the support of dense Pd membrane. However, small nickel cluster on surface caused defects on Pd membrane supported by porous Ni rod because porous Ni rod is made by uniaxial pressing. The effect of mechanical treatment was found to have a significant effect on surface to get rid of small nickel cluster as well as selectivity to reduce pore size. After 10 cycles electroless plating, as-deposited Pd film is uniform and defect-free except few pinholes. Pinholes were eliminated through 100 nmthick Pd thin film deposited by the DC magnetron sputtering process. The gas permeation properties of Pd membranes were characterized by permeation experiments with H_2 , N_2 , CO, and CO₂ single gases at 623K with a pressure of 1~4 bar. Also, gas permeation properties of Pd membranes were characterized by permeation experiments with mixture gas (N_2 :CO₂:H₂:CO:H₂O = 0.275:0.129:0.235:0.002:0.359 mole fraction) at 623 K with a pressure of 1~4 bar. It was clarified that the surface condition of porous nickel rod is very important to the H₂ permeability and selectivity because the permeation of H₂ gas was contributed by solution diffusion mechanis. And to conclude, Pd membranes on porous Ni support in this study showed superior performances, and proved to be impermeable to carbon monoxide.

Biography

Sun Hee Choi has completed his PhD from Seoul National University. She has published more than 30 papers in reputed journals.

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