Hydrogen separation by Pd-Cu composite membrane at elevated pressures and temperatures

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Palladium-copper composite membrane modules have been designed to recover high-purity hydrogen from an elevated pressure and temperature binary mixture of H_2/CO_2 (58.2:41.8 in vol%). Permeation and separation behavior of hydrogen was studied experimentally and theoretically using pure hydrogen gas and a binary mixture at 250-350 ℃ and 800-1200 kPa. The membrane modules presented maximum permeance at the highest temperature (350 ℃) both for pure H_2 gas and the binary mixture. When the permeate and retentate flowed in co-current flow, the module showed a temperature gradient and permeation flux variations. When the retentate flowed in counter-current flow to the permeate side, the temperature gradient and the uneven pattern of permeation flux were significantly stabilized, and the permeation flux improved by about 11% from that of the co-current flow module. The well-distributed temperature profile inside the module and increased hydrogen pressure difference through the membrane layer shortened the time to reach the steady state in the counter-current Pd-Cu membrane module, thus enhancing the membrane performance.