Direct production of fuel cell grade hydrogen via WGS reaction in catalytic Palladium-Copper membrane reactor combined with pressure swing adsorption process

방진아[1], 문동규[1,2], 강준호[1], 이창하[1,†]
[1]연세대학교; [2]Georgia Institute of Technology
(leech@yonsei.ac.kr†)

The combined process of Pd-Cu catalytic membrane reactor (CMR) and pressure swing adsorption (PSA) was conducted to refine syngas derived from coal gasifier into high purity hydrogen. The WGS reaction proceeded through a high-temperature shift (HTS) catalyst inside the Pd-Cu CMR, using a mixture of $CO/H_2/CO_2$ at 350 ℃, 6-10 atm, and various steam/carbon ratio. The reactor internal temperature profile, reaction conversion, and hydrogen recovery were studied. The temperature inside the reactor was distributed widely as the flow rate and feed pressure increased, and the conversion of reaction and the recovery of H_2 showed improved performance as the amount of pressure and steam increased. When comparing the performance with a fixed bed reactor, it showed a conversion enhancement. PSA simulation was added to the retentate flow of CMR to elevate the recovery of H_2. Through the application of the PSA process, the recovery was improved, and the high recovery based on fuel cell grade of CO impurity concentration was shown.