

가스화-WGS-분리막 연계 연소전 이산화탄소 포집 기술개발

이신근, 이성욱, 박종수\*, 오덕규, 서범석

한국에너지기술연구원

(deodor@kier.re.kr\*)

In this study, a combined test of the water-gas shift (WGS) reactor and a Pd-based composite membrane was carried out for pre-combustion CO<sub>2</sub> capture in a coal gasifier. The two series of WGS reactions, i.e., a high-temperature shift and a low-temperature shift, were performed under a gas composition of 60% CO and 40% H<sub>2</sub> at 2100 kPa to imitate coal gasification. The CO<sub>2</sub> enrichment and H<sub>2</sub> recovery tests at 673 K and 2100 kPa with the high-pressure membrane module after the WGS reaction presented the enriched CO<sub>2</sub> concentration and H<sub>2</sub> recovery ratios of ~92% and ~96%, respectively. The long-term stability test showed that the CO<sub>2</sub> concentration decreased to 78.2%, and CO was generated and reached to 8.8% in the retentate stream after 47 h because of reverse WGS and CO<sub>2</sub> hydrogenation reaction on 316L stainless steel module. The stability test for ~ 3137 h showed that these catalytic activities could be successfully prevented using steel with higher Cr and Ni contents, such as 310S. The WGS-membrane combination test using the outlet gas from a real coal gasifier was continued for ~100 h and showed that the WGS catalysts and membrane module made of 310S would be stable under real conditions.