Mixed oxygen ionic-carbonate ionic conductor membrane reactor for coupling CO2 capture with in situ methanation

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Abstract

CO2 methanation is one of the vital reactions to utilize CO2 and realize power to gas process. To decrease the CO2 capture cost and alleviate the hot spots during the strong exothermic methanation reaction, here, we report a coupling of CO2 capture process with in situ CO2 methanation process through a ceramic-molten carbonate (MC) dual phase membrane reactor over the Ni-based catalyst. The performance of the membrane reactor was systematically investigated and compared with the traditional fixed-bed reactor. The results show that the performance of the membrane reactor is higher than that of the fixed-bed reactor, since the produced steam through the methanation process can be partially removed through the dual-phase membrane, which promotes the reaction shift to right side. A stability test shows no obvious degradation within 32 h. These results indicate that the membrane reactor is promising for coupling CO2 capture with in situ methanation process.

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