디메틸에테르(DME) 자열개질 운전조건 최적화에 관한 연구

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Experiments of dimethyl ether autothermal reforming optimization.

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Dimethyl ether (DME) is an attractive fuel as a hydrogen carrier for mobile PEMFC applications. However, its reforming technologies are rarely studied especially by using autothermal reforming (ATR) method. This work explored the impact of operating conditions to the performance of DME ATR. Temperature, Steam to carbon ratio(SCR), Oxygen to carbon ratio(OCR) and Gas hourly space velocity(GHSV) were considered as the operating conditions. As results, conversion efficiency was increased as the temperature increased, but saturated around 700℃. There was no significant effect of SCR on conversion efficiency, but high SCR led reactions in endothermic manner. High OCR substantially suppressed conversion efficiency, but it helped to sustain the temperature by stimulating exothermic reactions. Conversion efficiency was decreased as GHSV increased. The optimized operating conditions was suggested: 700℃, SCR of 1.5, OCR of 0.45 and GHSV below 15000/h and conversion efficiency was ~85% at the conditions.

Key words : Dimethyl Ether(디메틸에테르), autothermal reforming(자열개질), conversion efficiency(전환효율), Operating condition(운전조건)

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고 탄화수소 개질을 위한 Pt-Ru, Pt-Ni 이원금속촉매에 관한 연구

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Pt-Ru, Pt-Ni bi-metallic catalysts for heavy hydrocarbon reforming

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Pt-Ru and Pt-Ni bimetallic catalysts were prepared and tested for heavy hydrocarbon reforming. Metals were supported on CGO($Ce_{0.8}Gd_{0.2}O_{2.0-x}$) by incipient wetness method. The prepared catalysts were characterized by Temperature programmed reduction(TPR). Oxidative steam reforming of n-dodecane was conducted to compare the activity of the catalysts. The reforming temperature was varied from 500℃ to 800℃ at fixed O_2/C of 0.3, H_2O/C of 3.0 and GHSV of 5,000/h.Reduction peaks of metal oxide, surface CGO and bulk CGO were detected. Reduction temperature of metal oxide decreased over the bi-metallic catalysts. It is considered that interaction between metals leads to decrease interaction between metal and oxygen. On the other hands, reduction temperatures of surface CGO were dectected in the order of Pt-Ru > Pt-Ni > Pt. low reduction temperatures of surface CGO indicates the low activation energy for oxygen ion conduction to metal. Oxygen ion conduction is known as de-coking mechanism of ionic conducting supports such as CGO. In activity test, fuel conversion was in the same order of Pt-Ru > Pt-Ni > Pt. Especially, 100% of fuel conversion was obtained over Pt-Ru catalysts at 500℃.

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Key words : Hydrocarbon reforming(탄화수소 개질), Diesel(디젤) Bi-metallic catalyst(이원금속촉매), Hydrogen(수소)

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