La-Zr-Ce Mixed Oxide Supported Co-Ni catalysts for Methane Dry Reforming

Teng Li Yu, Shawn D. Lin[1*], Guang Yu Chen and Chih-Xsiang Yang

National Taiwan University of Science and Technology
**E-mail: sdlin@mail.ntust.edu.tw*
MOST Project no.:107-222-E-011-064

In order to reduce greenhouse gas emissions, improving energy efficiency can lead to cut down of air pollution and, therefore, Methane Dry reforming becomes one of the important alternative energy providing method since it can directly convert carbon dioxide and methane to useful fuels. Our previous studies demonstrate that nickel with La_2O_3-ZrO_2-CeO_2 (Ni/LZC) support, prepared by co-precipitation method, has good Methane steam reforming catalytic performance at 500℃, having low CO selectivity (about 5%) and high H_2 yield (about 4). However, when Ni/LZC utilized in DRM at 500℃, it will cause lots of carbon formations. In this study, Co and NiCo(x=1, 3, 9) ,which x=Ni to Co molar ratio, loaded on LZC support are prepared and examined for DRM and compare with Ni/LZC. From XRD and TPR results, it shows that NiO particle size decreases and NiO reduction temperature is shift to higher temperature when lower loading percentages of cobalt are used(NiCo(x=3,9)/LZC). Furthermore, XAS data shows that the cobalt phase of NiCo(x)/LZC will present comparatively reduced than Co/LZC which shows as Co_3O_4 phase. NiCo(x)/LZC become much similar to CoO. From the DRM 20 hours' reaction performance at 500℃, it shows that NiCo(9) and NiCo(3) show much lower carbon formation than Ni/LZC and with excellent stability. The result shows that with lower loading percentage of cobalt in Ni/LZC can suppress carbon formation.