Syngas production from ethanol dry reforming using Cu-based perovskite catalysts

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Abstract:
This paper reports about production of syngas from dry reforming of ethanol (EDR) by using LaCuO$_3$ and CeCuO$_3$. The catalysts were prepared via the citrate sol-gel method and characterized by BET, TPO, H$_2$-TPR, FTIR, HR-TEM, SEM-EDX and XPS. The EDR tests were run in a stainless-steel fixed-bed reactor under the atmospheric pressure. Gas hourly space velocity, GHSV = 42 Lgcat$^{-1}$h$^{-1}$ and mean particle size 100 – 140 µm were used for all runs to ensure the negligible internal and external mass transport resistance. The X-ray diffraction analysis of LaCuO$_3$ and CeCuO$_3$ catalysts registered the phases of CuO, La$_2$O$_3$, CeO$_2$ and LaCuO$_3$ on the surface of the catalysts after calcination. The ethanol and CO$_2$ conversions were increased at excess CO$_2$ feed and decreased at excess ethanol feed under the pressure varied from 20-50 kPa. The metallic states of Cu, La$_2$O$_3$ and CeO$_2$ were confirmed with the XRD and XPS analysis. Two peaks of metal oxidation were recorded by H$_2$-TPR for both catalysts where LaCuO$_3$ showed lower reduction than CeCuO$_3$. Result of FTIR showed C-O, C-H and hydroxyl group beside metal oxides. The catalytic activity of LaCuO$_3$ is higher than the CeCuO$_3$ catalyst at stoichiometric ratios (Ethanol/CO$_2$: 1/1), 1023 K with the ethanol and CO$_2$ conversions of 74 and 18 % respectively.

Keywords: Ethanol Dry Reforming; Perovskites; Copper; Syngas
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