Highly Ordered Mesoporous Ce-Cu-Ni Composite Catalysts for Water-gas Shift Reaction

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H_2, the fuel for a fuel cell, is synthesized by fuel reforming process from simple carbohydrates or alcohols. Carbon monoxide formed during this process needs to be completely removed both because it is a pollutant and also because it poisons the platinum electrodes, thus hampering the fuel-cell performance. Carbon monoxide can be reduced and additional H_2 obtained via Water-Gas Shift (WGS) reaction which is represented following equation. [$CO + H_2O$ (g) $\rightarrow$ CO_2 (g) + H_2 (g)]. Ni catalysts have been considered as WGS reaction catalysts because of the high activity. Despite their activity, they have a crucial drawback, which they are also effective catalyst for the methanation reaction ($CO + 3H_2 \rightarrow CH_4 + H_2O$). This reaction leads to lower the efficiency of hydrogen production. Meanwhile, Cu catalysts have lower WGS activity than Ni catalysts, but they have been known for suppressing methane yield. Thus, Cu-Ni catalysts have been investigated for WGS reaction widely to achieve high activity and selectivity. Specifically, highly ordered mesoporous catalysts were prepared through nano-replication method using KIT-6.