Ordered Mesoporous CeO_2-based Binary Metal Oxide Catalysts for CO Preferential Oxidation

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The proton exchange membrane fuel cells (PEMCF) due to their high efficiency and wide applications with any emission. Hydrogen fuel in combination with PEMFC constitute a viable energy alternative to both stationary and mobile application [1]. However, carbon monoxide (CO) which inevitably presents in the reformate gas mixtures is a strong poison of the low temperature H_2-PEMFC. The concentration of CO must be blow than 100 ppm in H_2-rich stream that is used as fuel in PEMFC [2]. The CO preferential oxidation (CO-PROX) process has been recognized as one of the most effective methods to achieve this goal [3].

Among the numerous catalysts that have been examined for CO-PROX, materials consisting of ceria and transition metal due to their unique catalytic features and lower cost as compared to noble metals-based catalysts have demonstrated competitive levels of activity, selectivity and durability [4]

The catalysts structure have significant effect on the activity. Here, the mesoporous structure has large surface area, the uniformed pore system will benefit for the reactant gas diffusion, and the well-defined crystalline framework of mixed oxide could enhance the catalytic reactivity.

In this work, a series of ordered Ce-based binary metal oxide catalysts prepared by nano-replication method used KIT-6 as a hard template was evaluated in the CO-PROX reaction. The structure of the catalysts and the catalytic performance were characterized using X-ray diffraction (XRD), nitrogen sorption & adsorption isotherms, scanning electron microscopy (SEM), temperature programmed experiments. XRD showed the dopant metal were well dispersed in the CeO_2 lattice or the mixed oxide particle so small that beyond the XRD limitation.

The mesoporous Cu-Ce binary metal oxide showed the best CO-PROX catalytic activity among the prepared catalysts.

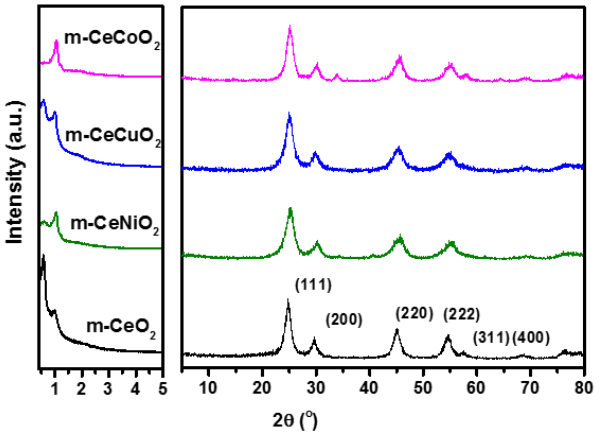

Fig.1 XRD pattern of the Ce-based binary metal oxide catalyst.

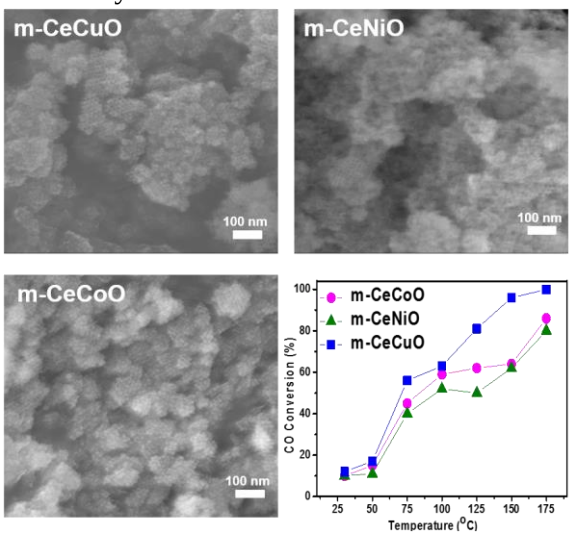

Fig. 2 SEM images and CO conversion with reaction temperatures of the Ce-based binary metal oxide catalyst.

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