Ceria–zirconia-copper oxide catalysts for CO removal from H_2-rich streams under PEMFC operating conditions

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Summary

On-board hydrogen production from hydrocarbons or alcohols has been proposed as the most efficient process to obtain hydrogen for feeding proton-exchange membrane fuel cells (PEMFCs). However, the gas produced after reforming and water gas-shift processes still presents in most cases a relatively high CO concentration, that disallows efficient handling of the fuel by the Pt anode usually employed in the PEMFCs. Preferential oxidation of carbon monoxide (CO-PROX) has been recognized as one of the most straightforward and cost-effective methods to achieve acceptable CO concentrations (<10 ppm). Among different types of catalysts for the PROX reaction, those based on Ce-Zr-Cu oxides [1-3] have shown promising properties in terms of activity, selectivity and resistance to CO_2 and H_2O.

In this work, a series of Ce–Zr–Cu mixed oxide systems, with different atomic ratios among cations, were prepared by slow co-precipitation with the aim to investigate the influence of the presence of very small amounts of zirconium on the performances of these three-component catalysts.

The activity of these materials was evaluated in the CO preferential oxidation in hydrogen-rich gas stream (1.2% CO, 1.2% O_2, 50% H_2, He balance) in the absence and presence of CO_2 and H_2O, in the 40-190°C temperature range. Correlations between catalytic activity and physico-chemical properties of the materials were made by X-ray Powder Diffraction (XRPD), N_2 physisorption, Temperature-Programmed Reduction (H_2-TPR), X-ray Photoelectron Spectroscopy (XPS).

Keywords: *Hydrogen; CO preferential oxidation; copper; ceria-zirconia.*

References

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