

## Stability Studies of Lanthanum Oxides as Co-catalysts for Direct Methanol Fuel Cells

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Although the use of alcohols directly to feed polymer electrolyte membrane fuel cells appears to be advantageous with Pt as anodic catalyst, they have a poor kinetic of electro-oxidation caused by the acid environment and the low working temperatures (80 to 120°C). A good anodic catalyst for these cells ought to show various functions: it has to promote the C-H bond cleavage during first adsorption steps and avoid CO poisoning.

Specific characteristics make rare earth oxides interesting for these catalytic studies. In some investigations it has been proposed that the oxidation of CO over ceria proceeds according to a radical mechanism through the interaction of CO molecules with adsorbed O. In the case of lanthanum oxides, this material can act as a storage component that reacts with the excess of oxygen. Then, the stored oxygen may be available for reaction with the reducing agents helping the conversion of CO. One of the possible applications of this type of composite electrode is the oxidation of methanol. In this field, lanthanum oxides are being studied as co-catalyst.

In the present paper, the activity and stability of lanthanum oxides as co-catalysts towards carbon monoxide and methanol oxidation are evaluated. First, the potential range of stability of the lanthanum oxide-Pt catalyst was studied by cyclic voltammetry and energy dispersive X-ray (EDX) analysis of the samples after application of different potential procedures. It has been observed that the positive potential limit applied is extremely important to avoid the loose of the rare earth oxide from the surface during potential cycling.

CO stripping, of the adsorbate formed at 0.20 V on supported Pt-lanthanum oxide/C has been performed at 0.01 V/s in sulfuric acid solution. It was observed that the onset for CO oxidation occurs at 0.48 V attaining a peak at 0.80 V with a shoulder at 0.70 V. The main difference with respect to Pt is the appearance of this shoulder at low potentials which has to be related to the presence of lanthanum oxides in the catalyst. On the other hand, electrochemical measurements revealed that the addition of these oxides significantly improve the electrode performance for methanol oxidation, in terms of the reaction activity and resistance to surface poisoning.

In this communication, results for CO as well as methanol electro-oxidation at Pt-lanthanum oxide/C electrodes will be present and the influence of the lanthanum oxides content considered. In situ Fourier transform infrared spectroscopy will be applied to obtain mechanistic information on these processes.