$LaNiO_3$-BASED CATALYST IN GAS DIFFUSION ELECTRODES: ACTIVITY AND STABILITY FOR OXYGEN REACTIONS

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ABSTRACT

Perovskite-type oxides are potential catalysts for next generation of regenerative fuel cells. In particular, $LaNiO_3$ has been recognised as one of the most promising oxygen electrodes. In this work $LaNiO_3$ perovskite-type oxides, prepared by a self-combustion method [1, 2], have been used for the preparation of porous gas-diffusion electrodes (GDE). Electrodes were prepared on Toray carbon paper (CP) substrates, consisting of a diffusion layer, a catalyst layer and a Nafion® layer. The gas diffusion layers were prepared using Vulcan XC-72R. The catalyst ink was prepared by suspending the material in isopropanol, stirring the mixture in an ultrasonic bath to thoroughly disperse it. Ink slurries were also pasted onto glassy carbon discs and used as working electrodes for full kinetic studies at potential domains for the oxygen reduction (ORR) and oxygen evolution (OER) reactions.
A systematic study on the effect of the oxide loading (*OL*) on the electrodes surface area was done by cyclic voltammetry. It was found a quasi linear variation between the electrodes surface area and the oxide loading. Roughness values varying from 106±3 to 307±6 were obtained for *OL* between 1 and 5 mg cm^{-2} respectively. The results show that the peak current density increases with the increasing on oxide loading as shown in Fig. 1. Higher current densities for *ORR* were obtained for the electrodes prepared using $LaNiO_3$-based perovskite with partial substitution of Ni by Cu. Stability studies of the GDEs, performed using a pre-defined cycling protocol in 1M KOH, will be discussed together with catalytic activity parameters relevant for their potential use as bifunctional oxygen electrodes.

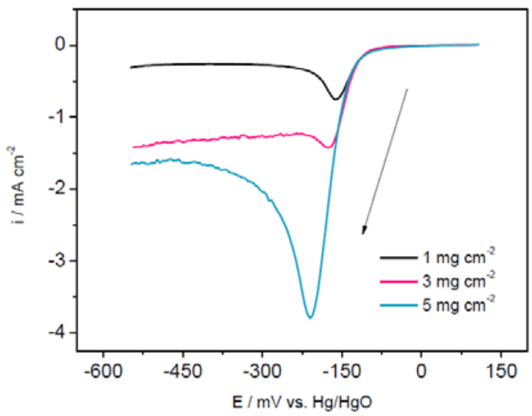

Figure 1: Linear voltammograms for CP/$LaNiO_3$, electrodes in 1 M KOH in O_2 atmosphere under stirring. Sweep rate v = 1 mV s^{-1}.

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