EVALUATION OF $La_2Ni_{1-x}Co_xO_{4\pm\delta}$ AS A SOFC CATHODE MATERIAL

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Recent work by a number of authors[1-5] has identified fast oxide ion conductivity in the K_2NiF_4 structured oxides. In particular the $La_2NiO_{4+\delta}$ material has been found to possess diffusion coefficients comparable with the known perovskite cathode materials. Coupled the reasonable electronic conductivity of ~100 Scm^{-1} at 650 ^oC these materials would appear to be good candidates for new cathodes. Preliminary measurements of the $La_2NiO_{4+\delta}$ composition as a symmetrical cell on a CGO electrolyte by Shaw[6] indicated that the overall performance was below that expected from the Adler model[7]. Subsequent work has also been carried out by Bassat and co-workers[8] investigating the $Ln_2NiO_{4+\delta}$ materials (Ln = La, Nd, Pr) on a YSZ electrolyte. From this work it was determined that K_2NiF_4 nickelates performed better in terms of the polarisation resistance than the corresponding perovskites.

In this work we have focussed on the B site doped $La_2NiO_{4+\delta}$ materials, where the dopant has been Co. A range of compositions, electrolytes and preparation routes have been investigated. We have been concerned mainly with the LSGM electrolytes as it was anticipated that the compatibility between the perovskite electrolyte and perovskite related cathode would be good. In order to provide a comparison cells were also produced using CGO electrolytes which were found to produce significantly greater ASR values. As well as varying the dopant concentration and the electrolyte we have also investigated using microwave sintering of the cathode. We have investigated the interface of the cathode/electrolyte using SEM to ensure that a satisfactory interface was produced, Figure 1.

The lowest area specific resistance values, Figure 2, were recorded from the $La_2Ni_{0.5}Co_{0.5}O_{4+\delta}$ (LCN) composition with this symmetrical cell achieving a value of ~1 Ω cm^2 at 800 ^oC on LSGM. These values were achieved using a relatively thick cathode painted on to the electrolyte and further optimisation of the deposition technique has resulted in the screen printing of the cathodes. Several compositions of LCN have been examined on both CGO and LSGM and the preliminary data from the 10 % Co doped samples show that the ASR for the material deposited on LSGM was 1.95 Ω cm^2 at 800 ^oC whilst that for those deposited on CGO was 11.35 Ω cm^2 at 800 ^oC. The reasons for these differences are not clear at this time.

Figure 1 – SEM micrograph of LSGM electrolyte with 10% Co doped $La_2NiO_{4+\delta}$ cathode layer.

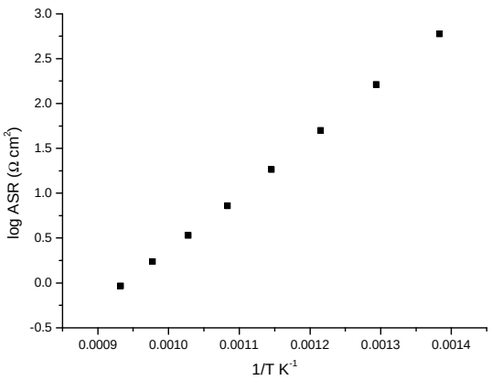

Figure 2 – Area specific resistance plot for $La_2Ni_{0.5}Co_{0.5}O_{4+\delta}$

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