Enhanced Electrochemical Properties of the Modified NiO Cathode for Molten Carbonate Fuel Cells

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Introduction

The durability of the MCFC has some problems for a long time operation. NiO is commonly used as the cathode for the molten carbonate fuel cell due to its stability and high electrical conductivity in molten carbonates and oxygen atmosphere. However, one of the most serious problems of MCFC to limit further application is the dissolution of NiO cathode material in molten carbonate medium. Many researchers have been trying to a lot of efforts to overcome this problem, and, as results, some materials, such as $LiFeO_2$ and $LiCoO_2$, have been reported for novel cathode materials. However, the application of these promising alternative candidates has still shown some problems originating from low electrical conductivity, high cost, difficulties of fabrication, etc.

Recently, surface modification by stable materials under the typical MCFC cathode condition has been studied. This modification can be used to protect the cathode material and hence to decrease the corrosion rates. Coating for enhanced surface and bulk properties of maintain is the most effective way to modification. [1-3]

In this study, various La-coated Ni powders have been synthesized as a new cathode material to reduce the solubility of cathode and to maintain the advantages of the NiO cathode. [4]

Experimental

The La-coated Ni powders were prepared using a polymetric precursor based on the Pechini method. The La-coated Ni cathode is made by usual tape casting method. The La-coated Ni green sheet was dried slowly at room temperature for 24 hours. After drying, the Ni green sheet was sintered at 800 - 950 ^oC in reducing atmosphere and the heating rate fixed to 3 ^oC/min.

X-ray diffraction (XRD) and scanning electron microscopy/energy dispersive spectroscopy (SEM/EDS) were employed in characterization of powder and cathode.

Results and Discussion

Figure 1 is indicates the scanning electron microscopy (SEM) and energy dispersive spectroscopy (EDS) images of the La-coated Ni powders obtained after calcination at 500 ℃ for 3 hours. From these SEM images, we can see that the surface of the Ni powder is homogeneously covered by La small particles. **Figure 2** shows the SEM images of the La-coated Ni cathode after sintering under reduction atmosphere. The morphology of the La-coated Ni cathode is shown to have a good pore structure for MCFC cathode.

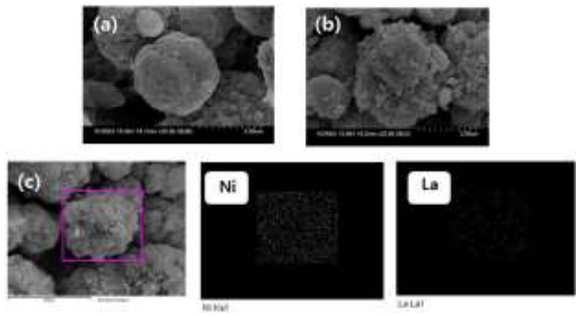

Figure 1. SEM image of pure Ni powder; (a) La-coated Ni powder; (b) images of (b), mapping of Ni and La ; (c). The sample was calcined at 500℃ for 3 hours.

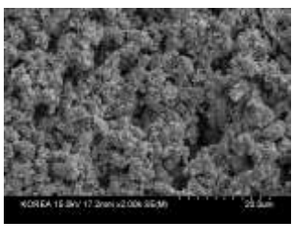

Figure 2. SEM images of the La-coated Ni cathode after sintering in the reduction atmosphere.

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