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A NEW CATALYST FOR CATHODIC REDUCTION OF OXYGEN: LANTHANUM NICKEL OXIDE

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The cathodic polarization characteristics of lanthanum nickel oxide, $LaNiO_3$, were investigated in O_2-saturated alkaline solutions and it was found that this oxide has a high catalytic activity for oxygen reduction. This paper represents the results in brief.

Electrochemical reduction of oxygen is one of the most important processes for energy conversion systems such as the fuel cell. A number of catalysts have been tested as the cathode for this device. However, there still exist great problems; for example, the cathodic reduction of oxygen on most catalysts occurs only in a high overpotential range. It has been reported that oxygen is cathodically reduced on a platinum catalyst[1] as well as platinum doped sodium tungsten bronze[2] at low overpotentials. Very recently, metallic oxides such as lithium-doped nickel oxide[3] and lanthanoid cobalt oxide[4] were found to be a good electrocatalyst for oxygen reduction.

It has been known that lanthanum nickel oxide of the general formula, $LaNiO_3$, has the perovskite-type structure similar to that of lanthanoid cobalt oxide and shows metallic conductivity[5]. This characteristic indicates its possible use as an electrode material for the purpose of oxygen reduction. In the followings, lanthanum nickel oxide was synthesized and tested as the catalyst for the cathodic reduction of oxygen.

Lanthanum nickel oxide was synthesized by a similar method to that reported by Wold,[6] using La_2O_3 and NiO as starting materials. Na_2CO_3 was mixed together with NiO and La_2O_3 as the flux and the mixture was heated at 850°C in air. The sample obtained was thoroughly washed with distilled water and then dried at 100°C. The electrode was prepared by pressing lanthanum nickel oxide together with the binder, Afron, at 250°C.

The cathodic polarization curve of the lanthanum nickel oxide electrode in O_2-saturated 1N-NaOH is shown in Fig.1. The data reported by Bockris[1] for platinum are also included in the same figure for comparison. It can be clearly seen from this figure that lanthanum nickel oxide electrode has the catalytic activity as high as that of platinum, at least in potential ranges investigated and satisfies the basic requirements for the cathodic reduction of oxygen.

It seems that the superior electrocatalysts for oxygen reduction like lanthanum nickel oxide exist among other lanthanoid nickel oxides. The study on the catalytic behaviors of lanthanum and some other lanthanoid nickel oxides is therefore in progress.

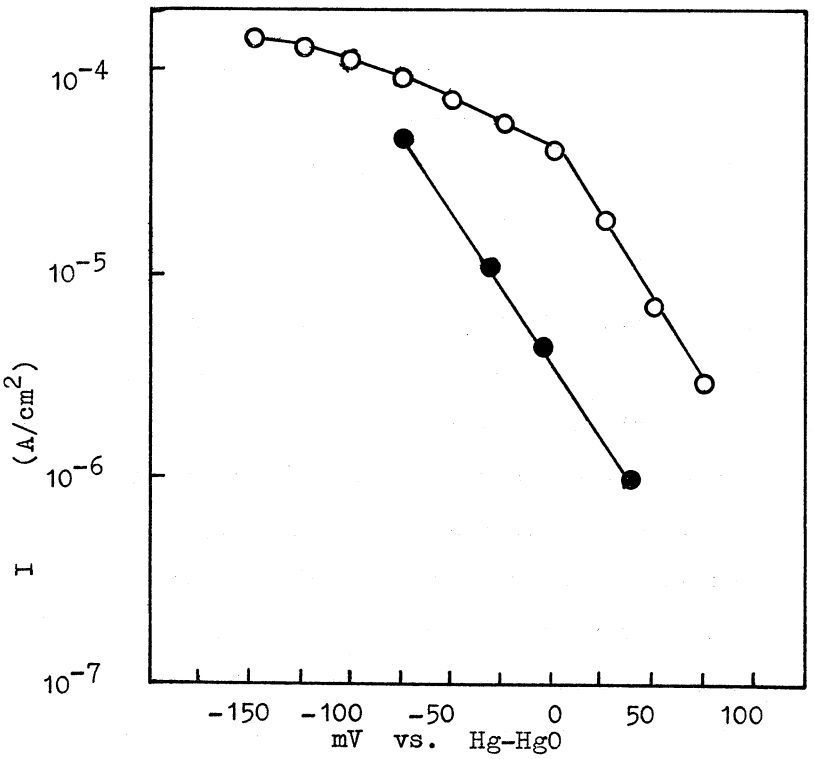

Fig.1. Current and potential relation of O_2 reduction.
○ : $LaNiO_3$ electrode in 1N-NaOH
● : Pt electrode in 1N-KOH

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