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New Ion Exchange Membrane Method Using Oxygen Evolution Anode for Seawater Electrolysis

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Summary

Contribution to salt industry of oxygen evolution anodes for seawater electrolysis we have developed is considered. It is application to the ion-exchange membrane process used in picking concentrated seawater in salt making process. Sodium hydroxide and hydrogen gas are generated in the cathode compartment in the process. The pH increase results in $Mg(OH)_2$ deposition on cation-exchange membrane in the cathode compartment, and the function of cation-exchange membrane is lost. To avoid the deposition, hydrochloric acid is added in the cathode compartment industrially.

From our research the $Mn_{1-x-y}Mo_xSn_yO_{2+x}/Ir_{1-x}Sn_xO_2/Ti$ anodes showed more than 99.9% oxygen evolution efficiency for 4200 h in the electrolysis of 0.5 M NaCl solution of pH 1 at the current density of 1000 Am^{-2}. It found that neutral sodium chloride solution was supplied first to the anode compartment and the low pH solution from the anode compartment was supplied to the cathode compartment. Such seawater supplying method contributes to energy saving and a little way of energy loss.

We used our oxygen evolution anode and solution supplying method for ion-exchange membrane process. Neutral sodium chloride solution was supplied and electrolyzed first to the anode compartment, and the low pH solution in the anode compartment was supplied to the cathode compartment. We predict that the application avoids $Mg(OH)_2$ deposition, the hydrochloric acid is reduced, and moreover the call voltage is small by electrolysis in the same whole pH.

In my research, we made a test cell and examined cell voltage, the pH and concentration of sodium chloride changed by the solution supplying method using the $Mn_{1-x-y}Mo_xSn_yO_{2+x}/Ir_{1-x}Sn_xO_2/Ti$ anode. We found that the pH of the anode compartment and the cathode compartment could be maintained fixedly similarly mostly by continuing to supplying the solution from the anode compartment to cathode compartment. This suggests the reduction in the cell voltage in during electrolysis. The degradation of ion exchange membrane was not observed due to $Mg(OH)_2$ deposition.