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Oxygen Evolution Anode for Artificial Seawater Electrolysis and the Possibility of a Novel Ion-Exchange Membrane Method Using the Same

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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 chamber industrially.

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 feeding contributes to energy saving and a little way of energy loss. This is applied to the ion-exchange membrane process in picking concentrated seawater. 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, to consider a possibility of this new system when oxygen evolution anode was used for ion-exchange membrane process, we made a test cell and examined cell voltage, the pH and concentration of sodium chloride changed by seawater feeding using an insoluble $Sn_{1+x}Ir_xO$ dioxide anode first. The pH of anode compartment went to down to about 1 and the cathode compartment went up to about 14 when the solution was static state and was electrolyzed. And it found that the concentration of sodium chloride continued to reduce in the desalting compartment and then the cell voltage continued to increase during electrolysis. We found that the increase in the cell voltage was avoided by keeping the concentration of sodium chloride solution by continuing to feed 0.5 M sodium chloride solution in the desalting compartment during electrolysis. In addition we found out that it was possible to reduce the cell voltage because the pH of the anode compartment and the cathode compartment could be maintained fixedly similarly mostly by continuing to feed the solution from the anode compartment to cathode chamber.