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Study of Cathodic Protection of Stainless Steel Using Oxygen Evolving Anode in Seawater of Sendai Bay

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Summary

In the salt production, the process of boiling down seawater that has been concentrated to 5-6 times the concentration of normal seawater using an ion exchange membrane method is called decoction. Since this pot operates under conditions of high temperature and high concentration, Iron, Stainless-clad steel, and Titanium-clad steel have evolved to suppress corrosion. However, even these materials are subject to corrosion and require replacement after a certain period of use.

There are coating corrosion protection, cathodic protection, and corrosion protection with corrosion inhibitor. Among them, cathodic protection is a method of preventing corrosion by applying an electric current to metals in water or soil and manipulating the potential. Cathodic protection includes the sacrificial anode method, in which base metals are electrically contacted, and the external power source method, in which an external power source is used.

A platinum metal such as Pt, which is stable in anodic polarization, is usually used for the anode used in the external power supply method for cathodic protection. It is considered possible to suppress the corrosion of the materials used by applying this external power supply method for cathodic protection to the boiling pot. However, if ordinary Pt or the like is used, harmful chlorine will be generated.

We have previously created an oxygen evolution anode that generates only oxygen without chlorine during electrolysis. It found that by using this electrode as an anode for cathodic protection in place of platinum, cathodic protection is possible in 2.5 M NaCl simulated seawater without generating chlorine or causing corrosion of stainless steel or iron.

In this study, we investigated the effectiveness of this method in actual seawater containing magnesium ions and calcium ions, and aimed to explore improvements for future practical use. As a result, Fe can be suppressed from corrosion when a current of 100 μA/cm^2 or more is applied. However, since excessive current density causes metals to precipitate as hydroxides, it found that potential control at a current value that keeps the potential (vs. Ag / AgCl) at -0.7 V is necessary. Similarly, it found that corrosion can be suppressed in SUS304 when a current density of 20 μA/cm^2 or more is applied.