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Development of Dissolved Oxygen Monitoring System for Corrosion Control of Salt Producing Plants

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Summary

For the better control of corrosion problems in salt producing plants, it is demanded to develop a monitoring system of dissolved oxygen in the plant solutions. The subject of this study is to propose a suitable manner of analysis in terms of sampling method, analysis principle and calibration method.

The dissolved oxygen concentration can be determined conveniently after sampling from plant lines using a newly designed outflow type of cell based on the linear relationship between the dissolved oxygen concentration and limiting current density for the reduction of oxygen on the rotating Pt electrode. The current density is then calibrated referring to both deoxygenated and aerated sample solutions. Pt electrode can be activated elctrochemically by the anodic polarization to 0.7 V (Ag/AgCl) prior to cathodic polarization. The existence of Cu^{2+} in the brine above 1 ppm interfered with the oxygen analysis because Cu deposited on Pt during the cathodic polarization. Meanwhile, anodic current peak for the stripping of the deposited Cu is useful for sensitive detection of Cu^{2+} in the solution, as was demonstrated for practical solutions. During the cathodic reduction of oxygen in the brine containing Fe^{2+} above 1 ppm, $Fe(OH)_2$ deposited on the Pt electrode due to the surface alkalization, causing a serious interference with the oxygen reduction reaction. Ni^{2+} ion up to 5 ppm showed scare effect on the electroreduction of oxygen on the rotating Pt electrode. These detrimental effects can be eliminated using a cation exchange method. The fluorescent oxygen meter can be set in the analysis line to make up the weakness against metallic contaminations, although the response is rather slow.

The analysis of oxygen concentration in the reference aerated sample solution by the Winkler method allows determination of absolute values of oxygen concentration in sample solutions. The calibration could be facilitated by placing an oxygen evolution electrode within a sampling tube based on the principle of standard addition method, which should be achieved in the immediate future.