

Determination of the Critical Conditions for the Use of the High Corrosion-resistant Metals in the Saline Plants Environment

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Summary

Stainless steels tend to suffer pitting corrosion under the saline plant environments, because of their elevated temperatures and the concentrated Cl^- conditions. The use of the Ni base alloys or the Ti alloys should be one of the solutions for the problem. However, even those high corrosion-resistant metals have possibilities for the crevice corrosion which can occur under the milder conditions as compared with the pitting corrosion. Moreover the costs of these alloys are the another problem. The critical conditions for the crevice corrosion can be determined in terms of the electrode potential, the temperature and the Cl^- concentration. Therefore if these critical conditions for the candidate corrosion-resistant metals were summarized, that would be very useful for the plant designers to avoid the corrosion accident before the construction. However the critical conditions for the high corrosion-resistant metals could not be determined with the simple immersion tests. Upon these circumstances, this study was started aiming to construct the data base of the above critical conditions by using the repassivation method, the concept of which has been developed by the authors. The Fe is one of the main impurity elements for the Ti. And the JIS Grade 1, 2 and 3 C. P. Ti is allowed to contain < 0.15 , < 0.20 and < 0.30 mass% of Fe respectively. Thus far, it was reported that although the Fe accelerate the active dissolution rate of the Ti in acid solutions, it has the effect to inhibit the crevice corrosion. However this effect has not yet evaluated quantitatively. In this work, the critical conditions of the crevice corrosion for the Ti - Fe alloys with the Fe contents of $0.012 \sim 0.42$ mass% was determined and successfully summarized in the Electrode Potential - Temperature - Cl^- Concentration Map. From the map, it was concluded that the small amount of the Fe content improve the the crevice corrosion resistance of the Ti significantly, and the C.P.Ti users have to pay attentions to the Fe content and refer the completed Map.