Effect of Cr concentration of carbon steel on flow-accelerated corrosion

Kazutoshi FUJIWARA[1], Yuta UCHIYAMA[1]

[1] Central Research Institute of Electric Power Industry, Japan

It is crucial to clarify the flow-accelerated corrosion (FAC) mechanism to manage the rational wall thickness of feed water systems in commercial power plants. In our previous study, we proposed an FAC model that would consider the diffusion of dissolved species between the oxide film/solution interface and the bulk solution. In this model, the effect of Cr concentration of material on FAC is evaluated; assuming Cr enrichment in the film and a resulting decline in the rate of dissolution. However, the correlation between the assumption and actual phenomenon remains insufficiently confirmed and should preferably be verified by experiments. In the present study, the influence of the Cr concentration of the material on the FAC rate was investigated by an FAC test using carbon steel with varying Cr content. The dissolved oxygen concentration was increased in a stepwise manner and the FAC suppression effect of oxygen for each specimen was investigated. The resulting performance of the FAC model was then examined from a material factor perspective.

The present study reached the following conclusions: 1) The FAC model can qualitatively reproduce corrosion behavior whereby the critical dissolved oxygen concentration, over which FAC becomes negligible, decreases with increasing Cr concentration in carbon steel. However, the model is overly sensitive to Cr concentration. 2) The Cr is condensed to the outermost layer of the film generated by FAC. The consistency of the FAC model, which assumes the enrichment of Cr in the film affects the dissolution property of the oxide film, was reconfirmed.