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Abstract

The re-design of the offshore platform in service for impressed current cathodic protection (ICCP) could remarkably solve the corrosion problems of potentially catastrophic environmental and financial consequences. A finite element model (FEM) of the offshore platform with biofouling is developed here to predict the effectiveness of the ICCP under seawater. Remotely operated vehicle (ROV) test verified that the offshore platform was fully covered by a coating-like biofouling to protect the structures from corrosion. FE-SEM and EDS tests demonstrated that elemental composition of biofouling deposits on the offshore platform mainly contained Ca, C, O, Si, Mg, Al, and Fe elements, indicating that magnesium oxides, biofouling deposits, and corrosion products were doped with calcium oxides in the formation of calcareous deposits. The polarization relationships of platform steel with biofouling coverage were used as boundary conditions for the numerical simulation. Furthermore, the factors including output current, anode location, seawater conductivity, and biofouling coverage rate, which influenced the protective effectiveness, were comparatively evaluated by FEM. Then, a re-design two-anode ICCP system was employed to keep offshore platform in protective condition. A ROV monitored the potential distributions of the legs and demonstrated that numerical simulation results of ICCP had a good agreement with measured data.

Figures used in the abstract

Figure 1: A re-design impressed current cathodic protection system