Study of the Initial Corrosion of X80 Steel in a Saturated Saline Soil Co-Contaminated with Cl^- , SO_4^{2-} and HCO_3^-

Fuli Ma¹, Ruizhen Xie¹, Pengju Han^{1,2,*}, Xiaohong Bai^{1,*}

¹ Department of Civil Engineering, Taiyuan University of Technology, Taiyuan, 030024, P. R. China

² State Key Laboratory of Hydraulic Engineering Simulation and Safety, Tianjin University, Tianjin, 300350, P. R. China

*E-mail: 13834569544@163.com, bxhong@tyut.edu.cn

doi: 10.20964/2018.06.33

Received: 5 January 2018 / Accepted: 30 March 2018 / Published: 10 May 2018

An orthogonal experimental group of saline soils with soluble salt anions (Cl^- , SO_4^{2-} and HCO_3^-) was designed by orthogonal assistant and IBM SPSS statistics 21 software. The initial dynamic potentiodynamic polarization of X80 steel embedded in different saline soils was tested using a three-electrode system. The statistical range and variance in the measurement data, the corrosion morphologies and composition of the X80 steel and the corrosion mechanism were analysed. The results show that the corrosion of X80 steel in S9 was the weakest, and the corrosion current density reached $4.9\text{E}-7$. The corrosive behaviour of X80 steel in different saline soils exhibited the following order: $\text{S9} < \text{S6} < \text{S3} < \text{S4} < \text{S5} < \text{S8} < \text{S2} < \text{S7} < \text{S1}$. The SO_4^{2-} anions mainly affected the corrosion potential, and Cl^- and HCO_3^- mainly affected the corrosion current density. The optimal contents of Cl^- , SO_4^{2-} and HCO_3^- in sandy soil are 1, 0.3, and 0.3 mmol/100 g for the R_p , respectively. The initial corrosion of X80 steel in different saline soils was weak, and mainly exhibited local pitting. SO_4^{2-} is the most important factor affecting the initial corrosion behaviour of the X80 steel. The Cl^- , SO_4^{2-} and HCO_3^- factors were not statistically significant ($P > 0.05$), which may be due to the level selection of the experimental factors.

Keywords: soluble salt anion; X80 steel; corrosion; orthogonal assistant; IBM SPSS statistics 21

[FULL TEXT](#)

© 2018 The Authors. Published by ESG (www.electrochemsci.org). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).