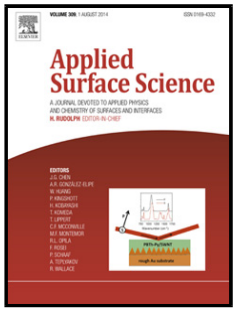

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Author: Sung Jin Kim Hwan Gyo Jung Gyu Tae Park Kyoo Young Kim

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Effect of Cu and Ni on Sulfide Film Formation and Corrosion Behavior of Pressure Vessel Steel in Acid Sour Environment

Sung Jin Kim[a,*], Hwan Gyo Jung[b], Gyu Tae Park[c], Kyoo Young Kim[a]

[a]GIFT, Pohang University of Science and Technology (POSTECH),
77 Cheongam-Ro, Nam-Gu, Pohang 790-784, Republic of Korea
[b]POSCO Technical Research Laboratories,
Geidong-Dong, Pohang 790-704, Republic of Korea
[c]SK Innovation Global Technology,
325, Expo-ro, Yuseong-gu, Daejeon, 305-712, Republic of Korea
**Corresponding author. Tel: +82 54 279 9236; Fax: +82 54 279 9299*
E-mail: pogksj@naver.com

Abstract:

The corrosion behavior of pressure vessel steel in acid sour environment is investigated in terms of the characteristic of iron sulfide film formed on the steel surface. The corrosion properties are evaluated by means of the potentiodynamic (PD) polarization, long-term potentiostatic polarization, linear polarization resistance (LPR) and electrochemical impedance spectroscopy (EIS). For the fundamental and mechanistic study on the corrosion behavior and the scale forming process, the change in anodic and cathodic component of the corrosion reaction is separately analyzed. For this, the numerical curve-fitting with Wagner-Traud equation to the PD polarization data is employed and various kinetic parameters are determined quantitatively. This study clearly reveals that the sulfide film formed on the surface of Cu and Ni bearing steel has smaller cracks than that on the steel containing only smaller Ni. Smaller cracks in the sulfide film suppress effectively anodic dissolution, hydrogen reduction and hydrogen diffusion through the steel, resulting in lower corrosion rate and higher resistance to hydrogen induced cracking.

Keywords: Pressure vessel steel, Corrosion, Iron sulfide, Sour environment, Polarization test, Hydrogen induced cracking