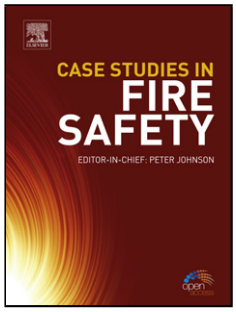

Title: Assessment of Local Conductivity Distribution in Stress Corrosion Crack Region Using Direct Current Potential Drop Method

Authors: Wenlu Cai, Shejuan Xie, Cherdpong Jomdecha, Xiaojuan Wang, Cuixiang Pei, Yong Li, Zhenmao Chen, Noritaka Yusa

PII: S0010-938X(16)30408-5
DOI: http://dx.doi.org/doi:10.1016/j.corsci.2017.01.019
Reference: CS 6984

To appear in:

Received date: 27-7-2016
Revised date: 20-1-2017
Accepted date: 20-1-2017

Please cite this article as: Wenlu Cai, Shejuan Xie, Cherdpong Jomdecha, Xiaojuan Wang, Cuixiang Pei, Yong Li, Zhenmao Chen, Noritaka Yusa, Assessment of Local Conductivity Distribution in Stress Corrosion Crack Region Using Direct Current Potential Drop Method, Corrosion Science http://dx.doi.org/10.1016/j.corsci.2017.01.019

Assessment of Local Conductivity Distribution in Stress Corrosion Crack Region Using Direct Current Potential Drop Method

Wenlu Cai [a], Shejuan Xie [a], Cherdpong Jomdecha [a], Xiaojuan Wang [a], Cuixiang Pei [a], Yong Li [a], Zhenmao Chen [a,*] and Noritaka Yusa [b]

[a] *Shaanxi Engineering Research Center of NDT and Structural Integrity Evaluation, State Key Laboratory for Strength and Vibration of Mechanical Structures, Xi'an Jiaotong University, Xi'an, 710049, China*

[b] *Department of Quantum Science and Energy Engineering, Graduate School of Engineering, Tohoku University, Sendai, 980-8579, Japan*

[*] Corresponding author. Tel. +86 29 82668736; fax: +86 29 82668736.
E-mail address: chenzm@mail.xjtu.edu.cn

Highlights

1. An inversion scheme was proposed and implemented for evaluation of the SCC electrical conductivity distribution with DCPD method.

2. The DCPD signals around SCC were measured and adopted for the conductivity reconstruction.

3. The multi-medium finite element was introduced to treat the SCC with complicated boundary.

4. A reasonable 2-dimentional conductivity distribution inside the SCC was firstly clarified.

As an effort to enhance the precision of quantitative nondestructive evaluation on stress corrosion crack (SCC) sizing with eddy current testing (ECT) technique, the electrical conductivity distribution in the SCC region was investigated in this work through measurement and inversion of the direct current potential drop (DCPD) signals with a sliced specimen strategy. An inversion scheme, consisting of an efficient forward DCPD signal simulator and the conjugate gradient optimization algorithm, was proposed and implemented for the reconstruction of the two-dimensional (2D) conductivity distribution inside the SCC. The reasonable reconstruction results from the measured DCPD signals of the practical SCC specimens proved the validity of the proposed scheme. The 2D distribution obtained in this paper shows that the conductivity becomes larger when approaching the crack tip and is the minimum in the crack opening position. The obtained SCC conductivity information gives a good reference to enhance the crack sizing accuracy of ECT.