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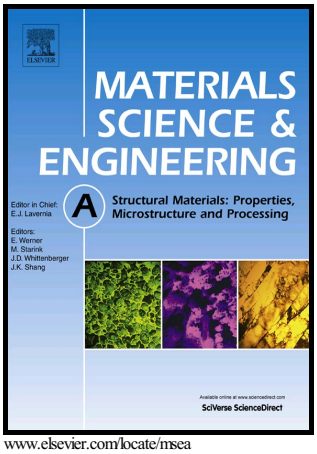

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Effect of plastic deformation on the electrochemical and stress corrosion cracking behavior of X70 steel in near-neutral pH environment

Zhongyu Cui[a, b], Zhiyong Liu[a*], Liwei Wang[c], Xiaogang Li[a], Cuiwei Du[a], Xin Wang[b]

a Corrosion and Protection Center, University of Science and Technology Beijing, Beijing 100083, China

b Institute of Materials Science and Engineering, Ocean University of China, Qingdao 266100, China

c College of Electromechanical Engineering, Qingdao University, Qingdao, 266071, China

Abstract: This work investigated the effect of plastic deformation on the electrochemical and stress corrosion cracking (SCC) behavior of X70 steel in near-neutral pH environment. The deformation-induced increase in electrochemical activity, dislocation density and heterogeneity, and surface roughness accelerated the corrosion, especially the cathodic reactions. Hydrogen absorption and permeation into the steel is promoted by the plastic deformation, resulting in the high hydrogen content of the pre-deformed steels. Moreover, the SCC susceptibility increases with plastic elongation, which is attributed to the enhanced anodic dissolution and hydrogen absorption.

Key words: pipeline steel; plastic deformation; electrochemical; hydrogen absorption; stress corrosion cracking

1. Introduction

Stress corrosion cracking (SCC) of steels in near-neutral pH environment has been a vital threat to the safe operation of buried oil/gas pipelines [1, 2]. The high strain caused by soil settlement, ground movement, bending over an unsupported span, and seismic loading are generated on the pipelines during service. The plastic

* Corresponding author: Tel: +86-10-62333931-502; Fax: +86-10-62334005.
E-mail: liuzhiyong7804@126.com