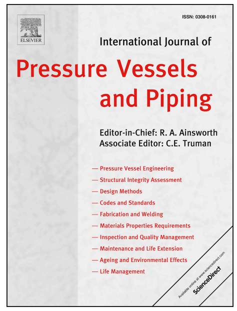
Accepted Manuscript



Monitoring creep damage at a weld using a potential drop technique

J. Corcoran, P.B. Nagy, P. Cawley

PII: S0308-0161(16)30212-5

DOI: 10.1016/j.ijpvp.2017.05.001

Reference: IPVP 3610

To appear in: *International Journal of Pressure Vessels and Piping*

Received Date: 1 June 2016

Accepted Date: 8 May 2017

Please cite this article as: Corcoran J, Nagy PB, Cawley P, Monitoring creep damage at a weld using a potential drop technique, *International Journal of Pressure Vessels and Piping* (2017), doi: 10.1016/j.ijpvp.2017.05.001.

Monitoring Creep Damage at a Weld Using a Potential Drop Technique

J. Corcoran[1*], P. B. Nagy[1,2], P. Cawley[1]

1. Department of Mechanical Engineering, Imperial College London, SW7 2AZ

2. Department of Aerospace Engineering and Engineering Mechanics, University of Cincinnati, OH 45221-0070, USA

* Corresponding author, joseph.corcoran07@imperial.ac.uk

Abstract

Welds of high-temperature pressurised components act as preferential sites for creep damage accumulation and will frequently be the life limiting feature. Type IV failures, where cracking occurs between the heat affected zone (HAZ) and parent material, are of particular concern in power station components. Typically damage will be characterised by locally high strain rates in the HAZ and local grain boundary separation leading to crack initiation and growth. A potential drop creep monitoring technique is suggested and demonstrated on cross-weld creep test specimens to be sensitive to both strain and cracking. The technique can be implemented as an array, discretizing a larger area into local measurements, providing contextual information and enabling the identification of local increases in damage. The influence of strain and cracking can be effectively separated to indicate crack initiation. The proposed sensor has very simple and robust high-temperature hardware lending itself to in-situ measurements in the field.

Keywords: ACPD, DCPD, Potential Drop, Creep, Weld, Type IV

1. Introduction

Creep failure at welds will often be the life limiting factor for pressurised power station components, offering a site for local damage accumulation. Overwhelmingly, concern around girth weld failure is associated with Type IV failure (Ellis, 1997; Perrin & Hayhurst, 1999; Viswanathan & Stringer, 2000; Cerjak & Mayr, 2008; Abson & Rothwell, 2013). Girth weld failures are driven by the cross-weld axial stresses arising from internal pressure and additionally system stresses such as the bending caused by the dead weight of the pipe (Cerjak & Mayr, 2008). High chrome steels are known to be particularly susceptible and the widespread adoption of P91 material