

Accepted Manuscript

Evolution of stress fields and phase content in corroded zirconium cladding materials

Kok Boon Chong, Michael E. Fitzpatrick



PII: S0257-8972(17)30551-0
DOI: doi: [10.1016/j.surfcoat.2017.05.072](https://doi.org/10.1016/j.surfcoat.2017.05.072)
Reference: SCT 22391
To appear in: *Surface & Coatings Technology*
Received date: 11 November 2016
Revised date: 19 May 2017
Accepted date: 24 May 2017

Please cite this article as: Kok Boon Chong, Michael E. Fitzpatrick , Evolution of stress fields and phase content in corroded zirconium cladding materials, *Surface & Coatings Technology* (2017), doi: [10.1016/j.surfcoat.2017.05.072](https://doi.org/10.1016/j.surfcoat.2017.05.072)

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Evolution of Stress Fields and Phase Content in Corroded Zirconium Cladding Materials

Kok Boon Chong^{a,c*}, Michael E. Fitzpatrick^{a,b†}

^aDepartment of Engineering & Innovation, The Open University, Walton Hall, Milton Keynes, MK7 6AA, UK.

^bCentre For Manufacturing & Materials Engineering, Coventry University, Engineering & Computing Building, Priory Street, Coventry CV1 5FB, UK.

^cJeffrey Sachs Center on Sustainable Development, Sunway University, No 5, Jalan University, Bandar Sunway, 47500 Selangor, Malaysia.

In this study, the evolution of stress fields and structural phase composition have been studied using Raman spectroscopy pre- and post-transition in the oxide layer of recrystallised ZIRLO and recrystallised zircaloy-4 (Zr-4) after corrosion exposure in a static autoclave. The structural phase composition analysis showed that the proportion of the tetragonal zirconia phase on the surface decreased with increasing corrosion time. High compressive stresses were found in the thin oxide, increasing with corrosion time, reaching a maximum in the transition period and decreasing slightly after that. The results show the relationship between the crystallographic phase and the residual stresses developed in the oxide.

Keywords: Zr Corrosion, Stress Fields, Phase Content, Raman Spectroscopy.

1 Introduction

Zirconium (Zr) alloys are widely used in nuclear reactor applications such as fuel cladding / channel materials, owing to their low neutron absorption cross-section, high mechanical strength and good corrosion resistance. Corrosion in zirconium alloys is a complicated electrochemical process which is influenced by several factors, including the properties of the metal/oxide interface, water chemistry, pressure, irradiation, and time. Although many reported works^[1-9] have studied numerous factors affecting the corrosion processes, and considerable understanding of the corrosion mechanisms have been secured, there are many effects that are still not fully understood: in particular, the relationships between the residual stresses that are generated between the oxide film and the substrate, the structural phase content, and the kinetics of corrosion. Better understanding can lead to the development of alloys

* kokboonc@sunway.edu.my

† ab6856@coventry.ac.uk

Download English Version:

<https://daneshyari.com/en/article/5465070>

Download Persian Version:

<https://daneshyari.com/article/5465070>

[Daneshyari.com](https://daneshyari.com)