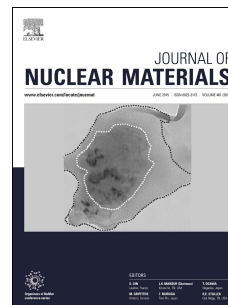


# Accepted Manuscript

Precipitates in metals that dissolve on cooling and form on heating: An example with hydrogen in alpha-zirconium

G.A. McRae, C.E. Coleman



PII: S0022-3115(16)30529-3

DOI: [10.1016/j.jnucmat.2017.09.017](https://doi.org/10.1016/j.jnucmat.2017.09.017)

Reference: NUMA 50503

To appear in: *Journal of Nuclear Materials*

Received Date: 2 August 2016

Revised Date: 11 September 2017

Accepted Date: 13 September 2017

Please cite this article as: G.A. McRae, C.E. Coleman, Precipitates in metals that dissolve on cooling and form on heating: An example with hydrogen in alpha-zirconium, *Journal of Nuclear Materials* (2017), doi: 10.1016/j.jnucmat.2017.09.017.

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.

1 **Precipitates in metals that dissolve on cooling and form on heating: an example with**  
2 **hydrogen in alpha-zirconium**

3 **G.A. McRae<sup>1</sup> and C.E. Coleman<sup>2</sup>**

4 **<sup>1</sup>Carleton University, Ottawa, Canada**

5 **<sup>2</sup>Canadian Nuclear Laboratories, Chalk River, Ontario, Canada.**

6  
7 **Abstract**

8 Einstein's theory for Brownian motion and Gibbs' Phase Rule along with diffraction of high  
9 intensity X-rays have been used to provide an interpretation of precipitation and dissolution in  
10 metals using hydrides in alpha-zirconium as an example. Hydrides precipitated, and dissolved  
11 during cooling, and at some temperatures, their amounts increased with heating. Hydrides were  
12 seen to precipitate without exothermic signals both above and below the solvus temperature, and  
13 on heating, were found to be stable above the solvus temperature. Hydrides were inferred to  
14 form composites with the delta phase surrounded by gamma phase. These results are interpreted  
15 with Cottrell atmospheres of hydrogen atoms that relieve the stress around dislocations, and  
16 hydrogen clouds from stresses around hydrides making them stable against dissolution leading to  
17 maxima in the amounts of hydrides with change in temperature. A vertical line corresponding to  
18 ZrH is suggested to be added to the equilibrium phase diagram to comply with the Phase Rule.

19 **Keywords:** precipitation; dissolution; diffraction; hydrides; zirconium; Cottrell atmospheres,  
20 hydrogen clouds, elastic stress concentration factor

21

Download English Version:

<https://daneshyari.com/en/article/7963652>

Download Persian Version:

<https://daneshyari.com/article/7963652>

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