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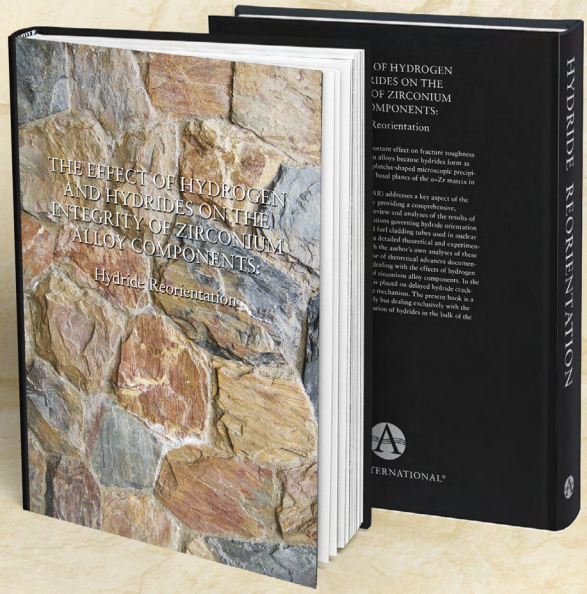
NEWSLETTER FROM A.N.T. INTERNATIONAL No.37 2018



NEW STAND ALONE REPORT!

THE EFFECT OF HYDROGEN AND HYDRIDES ON THE INTEGRITY OF ZIRCONIUM ALLOY COMPONENTS: Hydride Reorientation

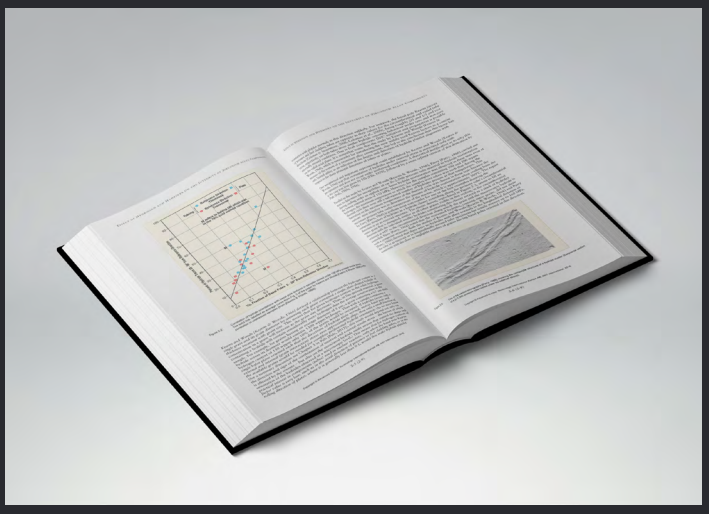
by Dr. Manfred Puls

ABOUT THE AUTHOR – PRODUCT INFORMATION – SAMPLE

The Effect of Hydrogen and Hydrides on the Integrity of Zirconium Alloy Components: Hydride Reorientation

Hydride orientation has an important effect on fracture toughness of hydride-containing zirconium alloys because hydrides form as approximately linear arrays of platelet-shaped microscopic precipitates with habits on or near the basal planes of the α–Zr matrix in which they form.

This Stand Alone Report (SAR) addresses a key aspect of the issues raised in the foregoing by providing a comprehensive, self-contained and up-to-date review and analyses of the results of studies carried out on the conditions governing hydride orientation in zirconium alloy pressure and fuel cladding tubes used in nuclear reactors. The report combines a detailed theoretical and experimental overview of this subject with the author's own analyses of these results. These analyses make use of theoretical advances documented in the author's 2012 book dealing with the effects of hydrogen and hydrides on the integrity of zirconium alloy components. In the author's 2012 book, emphasis is placed on delayed hydride cracking, which is a localised failure mechanism. The present book is a follow-up to the foregoing study but dealing exclusively with the conditions affecting the orientation of hydrides in the bulk of the material.



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Editor & publisher: Peter Rudling

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ABOUT THE AUTHOR

Dr. Manfred Puls has a PhD degree in Physics from McMaster University, Hamilton, Ontario, Canada. After spending a year as a post-doctoral fellow at McMaster, he joined AECL, retiring from AECL in 2006 after 35 years of service. The first 20 years of service in AECL were spent as a researcher, whilst the remaining 15 were spent in various management positions, the last 9 of which were at AECL's Engineering Company located in Missisauga, Ontario. At that site he managed a resource group of engineers consisting of many of the company's experts for the design, build support, development, life management and service of fuel channel technology in CANDU reactors.

Throughout his graduate studies and his stay at AECL, Puls was involved in research, design and development activities covering a wide range of technical topics and fields, only a few of which are noted here, as follows:

- phase transitions and phase equilibria (hydride formation, critical phase transitions),
- diffusion controlled processes (delayed hydride cracking, creep crack growth);
- fracture (critical crack propagation, delayed hydride cracking, hydride blister fracture);
- properties of point defects and dislocations and their interactions in crystalline solids based on atomistic models of dislocations and point defect/dislocation interactions in ionic and metallic crystals;
- development of an improved calandria tube design and specifications for the manufacture of improved pressure tubes.

After retirement from AECL, Puls worked as a consultant with Kinectrics Inc. (the privatised successor company to the Ontario Hydro Research Division) on topics associated with ensuring that DHC can be prevented in pressure tubes of operating CANDU reactors. In 2012 Puls published a book through Springer-Verlag, U.K. The book has the same main title as the SAR being marketed in this brochure. The focus of the 2012 book was on DHC whilst the SAR being promoted in this brochure deals with the science and conditions for hydride reorientation, given that the orientations of hydride precipitates play an important role in impacting the fracture toughness of zirconium alloys.

Further details of Puls' research activities and publications can be found under his ResearchGate profile: *https://www.researchgate.net/profile/Manfred_puls2*.

Puls has been a member of various international and national organizations such as:

- Canadian representative to the International Working Group on Life Management of Nuclear Power Plants (IWG-LMNPP); an IWG operating within the Nuclear Power Division of the International Atomic Energy Agency, Vienna, Austria.
- Chairman of the CANDU Owners Group (COG) DHC & Fracture Working Party and member of the Fuel Channel Program Technical Committee.
- Member of, and contributor to, the Subcommittee on Technical Requirements for In-Service Evaluation of Zirconium Alloy Pressure Tubes in CANDU Reactors, a committee responsible for the technical content of a new CSA Standard, CSA N285.8, Technical Requirements for In-Service Evaluation of Zirconium Alloy Pressure Tubes, the first version of which was published in 2005.
- Member of the Editorial Advisory Board of the Journal of Nuclear Materials.

Read Dr. Puls' full biography

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