

**ANALYSIS OF *IN-SITU* DEFORMATION OF HYDRIDED ZIRCALOY-2 BY
SYNCHROTRON X-RAY DIFFRACTION**

M. Kerr, M.R. Daymond, and R.A. Holt, Department of Mechanical and Materials
Engineering, Queen's University
J.D. Almer Advanced Photon Source, Argonne National Laboratory

Sponsored by NSERC, COG, OPG and Nu-Tech Precision Metals under the Industrial
Research Chair Program in Nuclear Materials at Queen's University

The formation of brittle hydrides and their influence on the fracture properties of the component in which they form is a life limiting phenomenon for zirconium alloys. The mechanical properties of the hydrides themselves are inferred from mechanical tests on material containing hydrides or bulk hydrides, leaving considerable uncertainty regarding the *in-situ* hydride response. In this paper, we report the first direct measurements of the mechanical response of zirconium hydride, *in situ* in a Zircaloy-2 matrix. Moduli values for the hydride phase are reported and a fracture criterion for the hydrides is proposed. Finally, measurements of crack tip strain fields in Zircaloy-2 are presented as starting point for the study of crack tip hydrides.