An evaluation of the segmented expanding cone-mandrel test to assess hydride re-orientation and ductility reduction for Zircaloy-2 cladding tubes

Abstract:
This paper presents the segmented expanding cone-mandrel (SECM) test for thin-walled cladding tubes and quantifies its sensitivity to inherent uncertainty factors such as friction. The SECM test is then applied to study hydride re-orientation and embrittlement of pre-hydrided Zircaloy-2 cladding by cyclic thermo-mechanical loadings to induce radial hydrides followed by a ductility test. The paper shows that the SECM can be used to induce hydride re-orientation but the repeatability of the re-orientation needs to be improved. The loss of ductility from radial hydrides can be well quantified with respect to the radial hydride content. The ductility reduction from radial hydrides is however a three-dimensional problem and accurate quantification requires a three-dimensional model.

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