Enhancing Nuclear Fuel Efficienc through Improved Understanding Irradiation Damage in Zirconium Cladding

Michael Preuss



Dimensional instability can lead to bowing and buckling of assemblies

erial and Performance





Characterisation 600 intensity 400 200 Iron Zirconium

Possible Mechan

SPP amorphisation:

- dissloved elements stay vicinity of SPP

Early Growth and Creep:

- <a> loop density and in strains continuously increased
- effect of fast/slow diffus elements on <a> loops d
-SIPA is correct

<c> loop nucleation:

- Nb and Sn slows down nuclation
- interstitial elements dis
 SPPs act as nucleation s
- intergranular strain dire
 <c> loop formation
- deformation due to inter strain initiates loop nucle

- amples from Studsvik Nuclear to University of lanchester
- R funding early career fellowship in support of the rogram
- CF now established to carry controlled proton radiation experiments.
- ignificant progress by applying STEM based ultra igh resolution EDX mapping and diffraction based ne profile analysis
- ew mechanisms have been proposed for c-loop prmation and the role of Fe during irradiation in Zr lloys
- uclear industry continues funding PhD students to eep the program going











r research activity has grown dramatically, UK now leading as evide om ASTM Zr conference in 2016 and UK will host ASTM Zr confere n 2019



significant collaborative research activity developed through bottom pproach, example:

- MUZIC 1: UK consortium funded by EPSRC to identify corrosion mechanisms alloys
- MUZIC-2: UK, US, France, Sweden, Switzerland consortium funded by EF Nuclear industry funding, Swedish Council, Swiss Nuclear to identify hydroge pick up mechanism
- MUZIC-3: UK, US, France, Sweden, Switzerland consortium to study effect irradiation on corrosion and hydrogen pick up mechanisms

0 Zr coupons from a BOR60 irradiation campaign to arrive in the UK before end of 2016 and to be stored k INL (NFIR program)

Great opportunity for UK

