UNIVERSITY OF LIVERPOOL

MAINTAIN: Multi-ScAle INTegrity for Advanced high-temperature Nuclear systems

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wood.

UK Atomic Energy Authority

EDF ENERGY

OAK RIDGE National Laboratory

Investigators

- **Bristol** - Mahmoud Mostafavi (PI), Peter Flewitt, Chris Truman
- **Oxford** - Ed Tarleton, James Marrow, Dave Armstrong, Alan Cocks
- **Manchester** - Joao Quinta da Fonseca
- **Liverpool** - Karl Whittle, Eann Patterson (Phil Edmondson - ORNL)

Aims

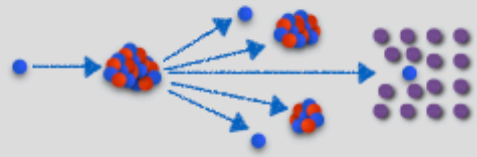
- Include the effects of radiation damage into SI creep codes
  - Current and future material options
- How it impacts long term behaviour
  - Comparison between ions and neutron irradiated
- Validated Multiscale Modelling
  - Incorporation into codes such as R5

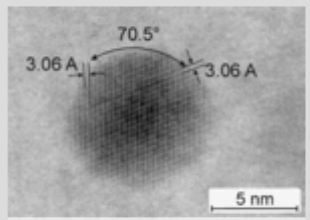
Methodology

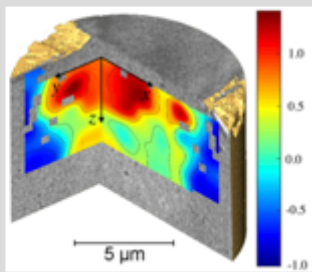
Experiment

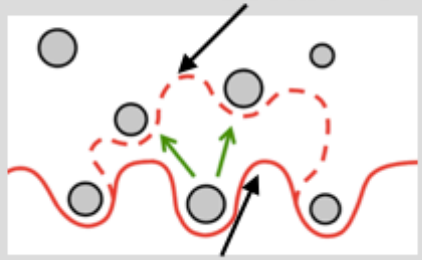
Modelling

WP1: Nano to Micro

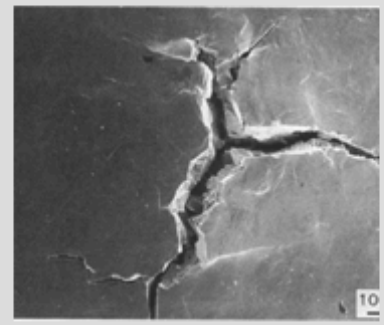


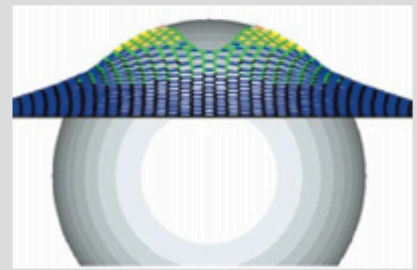


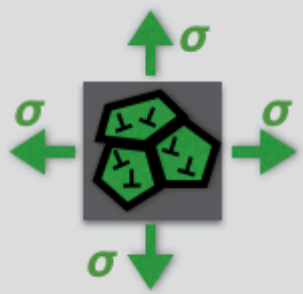




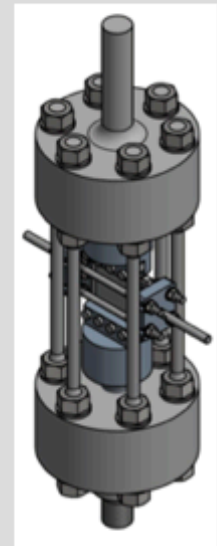
WP2: Micro to Meso





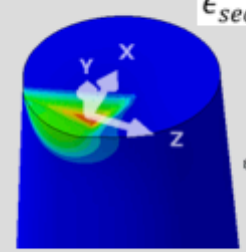


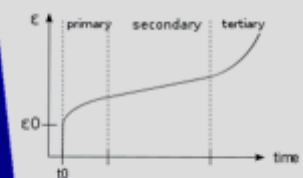
WP3: Meso to Macro



$$\epsilon^c_{primary} = A_p \sigma^{n_p} t^{m_p}$$

$$\epsilon^c_{secondary} = A_s \sigma^{n_s} t$$





Volume (μm^3)

10^3 10^9 10^{14} 10^{20}

Update

Initial models developed – next stage is to verify

Neutron irradiated material analysis continues

Working with EDF R&D (France) simulating the behavior of EPR RPV as it gets irradiated

Incorporated into EU Project ENTENTE

Integrated the method into EDF High Temperature Centre – linked with AGRs