UCSB-2 Experiment Design in the Advanced Test Reactor

TRTR Presentation

Principal Author and Presenter: Mike Sprenger

August 7, 2014

www.inl.gov

Idaho National

Laboratory



Experiment Objectives

- Reactor life extension in the United States requires predicting neutron embrittlement of reactor pressure vessel steels at low to medium reactor flux and high fluences. Currently this data does not exist.
- As result of this lack of data, the National Scientific User Facility (NSUF), the University of California Santa Barbara (UCSB) and Idaho National Laboratory (INL) developed the UCSB-2 experiment.
- This experiment required an active in-situ temperature and pressure control or "Leadout" type experiment vehicle.
- The Leadout UCSB-2 experiment contained a new designed ATR vessel closure flange, test train, and gas temperature control system.

Idaho National Laboratory

Experiment Objectives

- The peak flux of approximately 3.8x10¹² n/cm¹²-s will produce a maximum fluence of 1x10²⁰ n/cm².
- The UCSB-2 experiment contained approximately 1664 coupon specimens which were prepared by UCSB.
- The coupons were irradiated at temperatures of 250, 270, 290, and 310 degrees C. Temperatures were maintained within 15 degrees C.



UCSB-2 Coupons



Figure 1 Schematic drawings of: (a) diffusion multiple; and (b) He implanter discs.





UCSB-2 Coupons



Figure 3 Drawing of the DCT specimen.

Figure 4 Schematics of a chevron notched wedge specimen.



UCSB-2 Experiment Coupon Capsule Details





Coupon Capsules





Coupon Capsules Being Loaded into Test Train





Spacers and Dosimetry Being Loaded into Test Train







Inner Capsule





UCSB-2 Experiment Inner Capsule Detail





Outer Tube Over Inner Capsule





Outer Tube and Inner Capsule





Outer Tube Provides Gas Gaps





Pressure Tube Contains Outer Tube and Assembly





UCSB-2 Experiment Coupon Holder Loading





UCSB-2 Experiment Test Train Cross Section





TC and Gas Line Leads Terminated





Upper Flange Head





UCSB-2 Experiment In-Vessel Leadout Assembly





UCSB-2 Experiment





Experiment Type and Location in ATR Core

UCSB-2 Instrumented Lead Experiment will be installed and irradiated in the I-22 (1.5") core position.





ATR

Core Cross Sectional Diagram

UCSB-2 Experiment

I-22



Experiment Handling and Insertion







Interface with Reactor Vessel





L-7 Flange From Inside Nozzle Trench

L-7 Flange From Inside Vessel



Inner Flange Assembly





Gadolinium Basket





UCSB-2 Experiment Gadolinium Basket Details





Removed From Core, Staged In Canal, Ship Irradiated Experiment to MFC







