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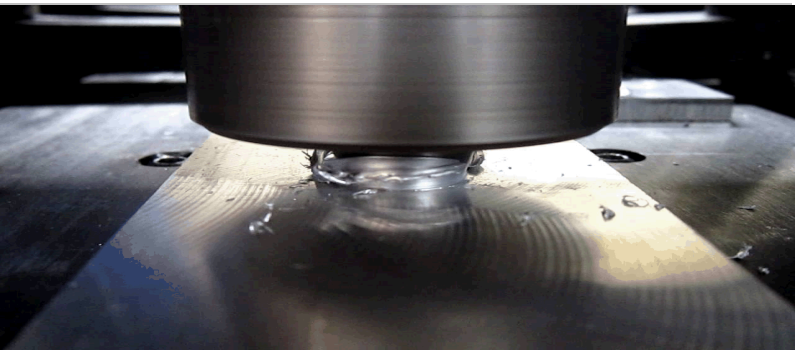
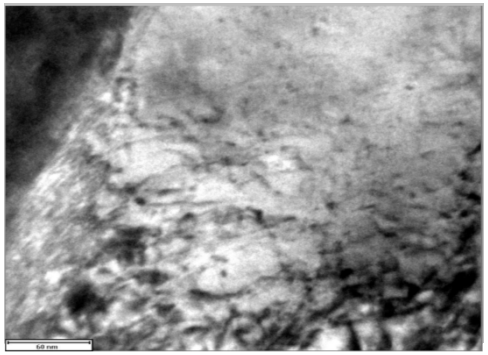




MAC Program Outbrief – MIDN Brian Tobie

Radiation Stability of Friction Stir Welds

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

Research Background

- Oxide Dispersion-Strengthened (ODS) Steel MA956 is a candidate for use as cladding in advanced fast reactor designs
- Welding is a common way of forming cladding
- Welds are commonly the sites of failure
- On top of already increased failure rate in welds, questions remain regarding how radiation affects welds

USS Maine, 1898

SS Schenectady, 1943

USS Thresher, 1963

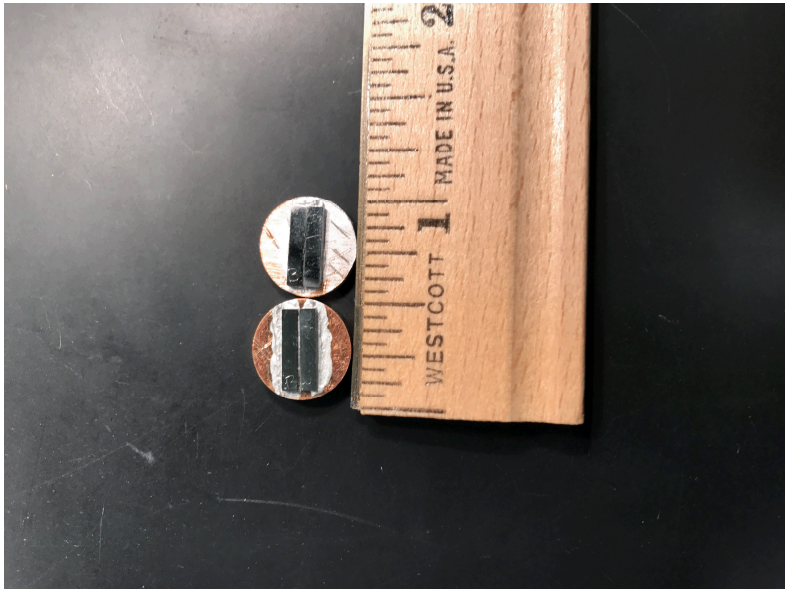
Research Plan

- Primary goal: observe differences in the effect of radiation on stability of base material and welded material
- Secondary goal: determine the effect of in-situ irradiation on results as compared to ex-situ
- Method: Irradiate 8 specimens as shown below at 450° C

Sample	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Weld(W) /Base(B)	B	W	B	W	B	W	B	W
Dose (dpa)	1	1	25	25	1	1	25	25
ex-situ/in-situ	Ex	Ex	Ex	Ex	In	In	In	In

Research Plan

- Why ion irradiation?
  - Less time, less money
  - Surrogate for neutron irradiation
- Unsure about energy and ion species

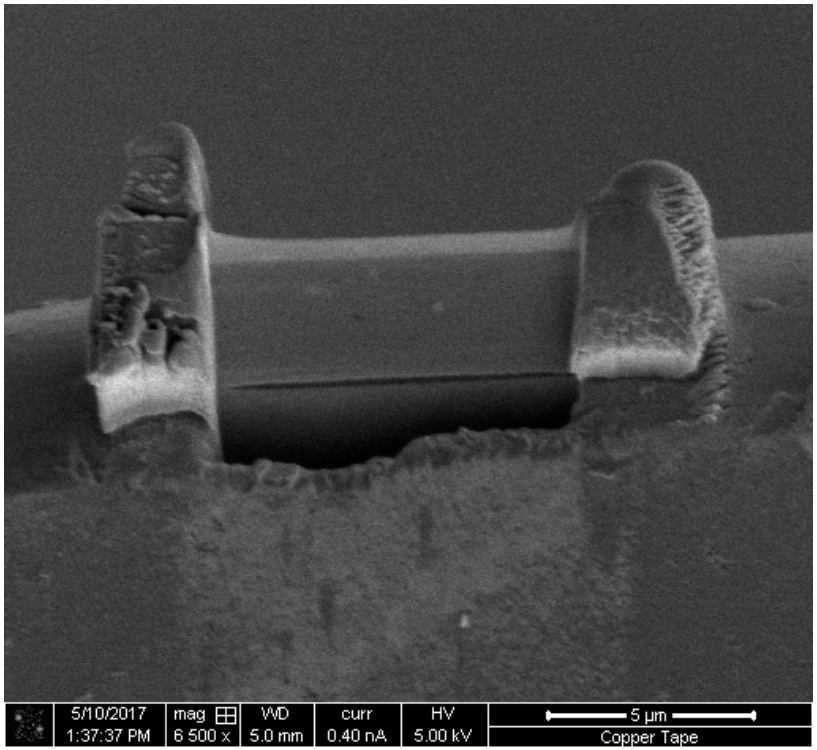


Experimental layout for ex-situ samples

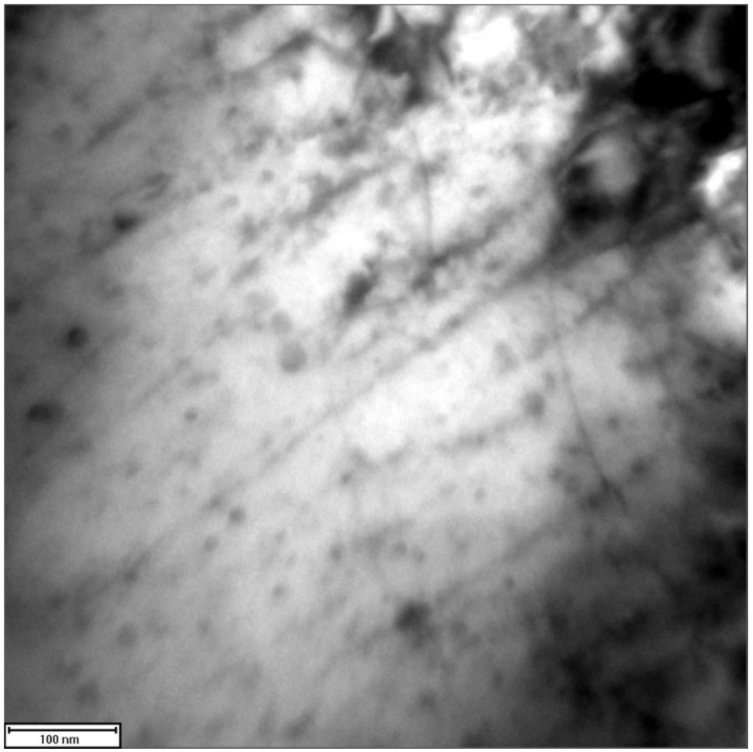
Button heater used in ex-situ irradiations

Steps Prior to Arrival

- Primarily sample prep
  - Professor Getto used FIB to create TEM samples (in-situu)
  - Machine shop at USNA created bulk samples (ex-situ)



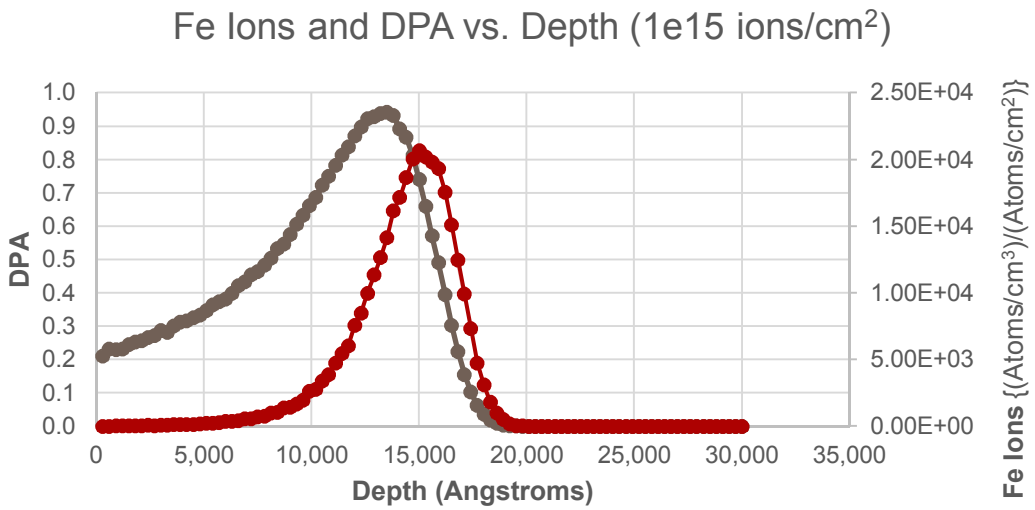
SEM image of sample



TEM image of sample

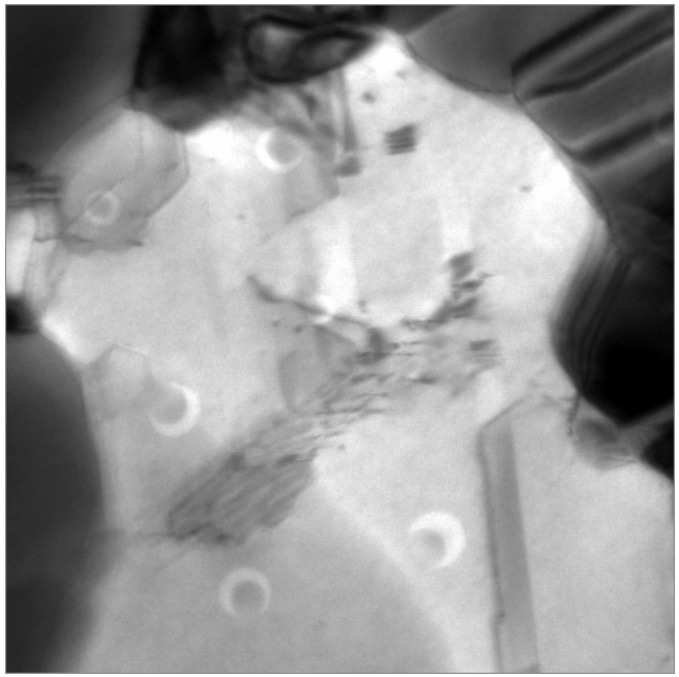
Steps Taken at Sandia

- Run SRIM calculations to determine method of irradiation
  - Minimize time and ion contamination for certain dose
  - 5 MeV Fe++ was decided upon
- Copper disk contained one weld sample and one base sample
- One set was irradiated to 1 dpa, the other to 25 dpa
- Ex-situ irradiations are complete

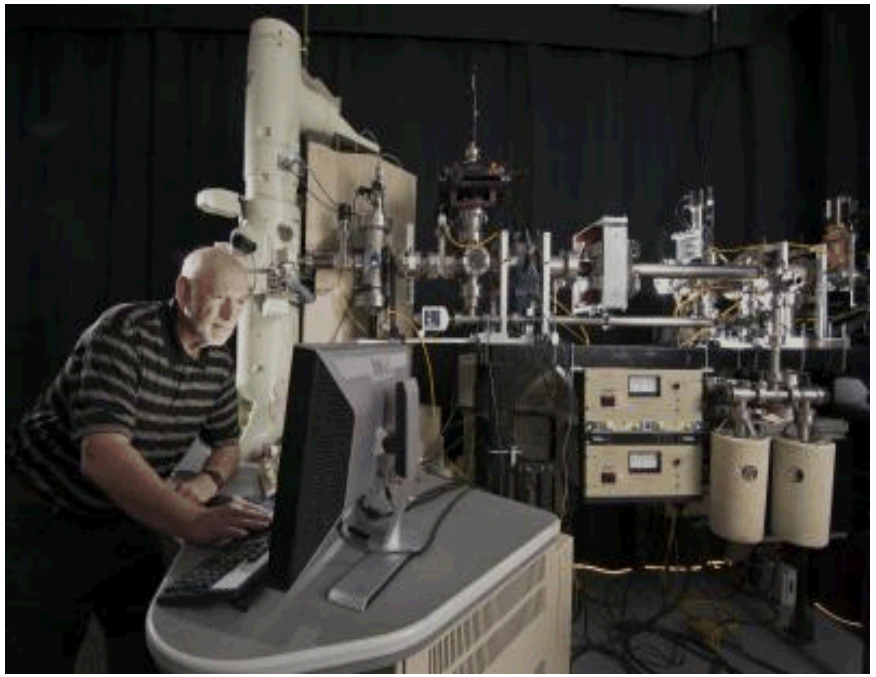


Future Steps

- Complete in-situ irradiations (tentatively scheduled for 06/30)
- Examine the effect of irradiation on the samples
- Examine the difference between the in-situ and ex-situ samples of the same dose



Au ion implantation

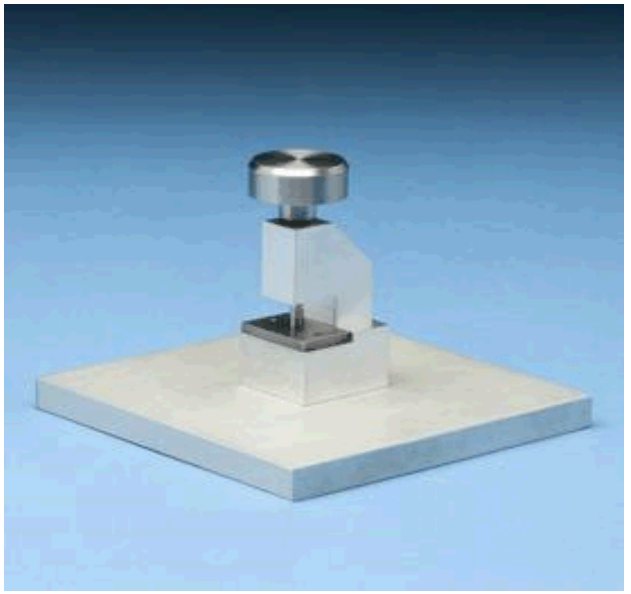


Sandia's TEM Lab

Miscellaneous Tasks

- Due to the involved nature of the research, I engaged in other tasks as well during my time at Sandia:
  - Receiving & storing TEM assembly from Sandia in California
  - Prepping a copper disk mount for the ex-situ irradiations
  - Grinding/polishing of zirconium for future studies
  - Technical Work Documents (TWD's)

Lapping and polishing machine



2.3 mm metal punch

Credits

- Sandia National Laboratories
  - Ion Beam Laboratory team
  - MAC Program
- United States Naval Academy
  - Dr. Elizabeth Getto
  - CDR Bradford Baker, USN

Sandia's Ion Beam Lab


Professor Elizabeth Getto


CDR Bradford Baker

Questions?

Sandia National Laboratories