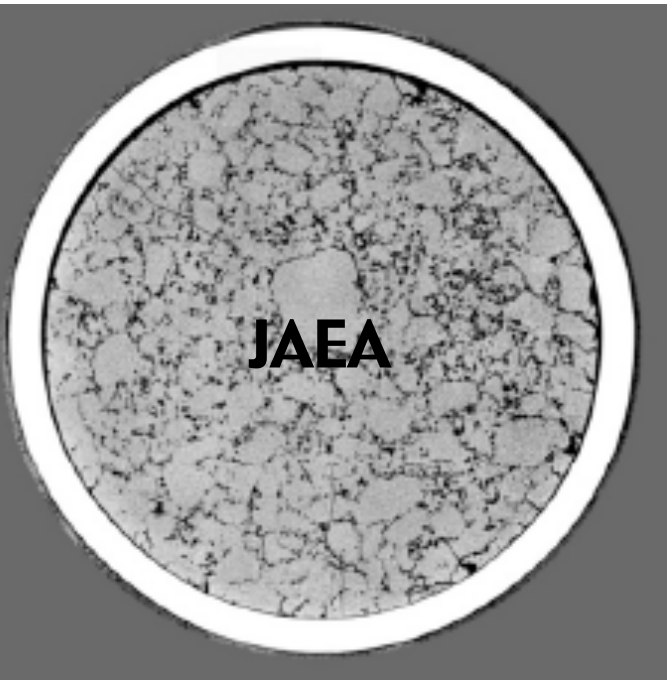
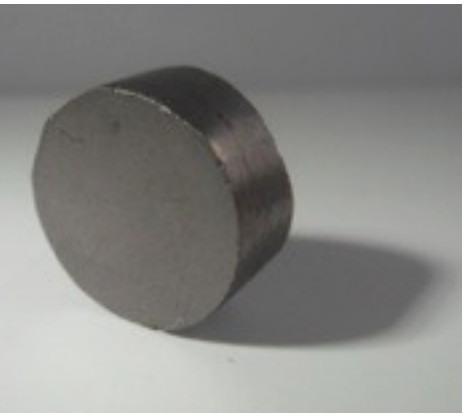
- The use of inert matrix fuel permits to minimize core size.
- Several inert matrix fuels exhibit good performance under irradiation
- PuO_2–MgO (BOR-60)
- $(Pu,Am)O_2$–Mo (HFR)
- $(Pu,Zr,Y)O_2$ (Halden)
- (Pu,Zr)N (BOR-60, JMTR, HFR, ATR)
- Inert matrix nitride fuels offer highest Pu density, hence smallest core size for ELECTRA.

- Two phase PuN-ZrN fuel fabricated by VNIINM
- Metallic source material
- 16% initial porosity
- Irradiation in BOR-60 up to 19.4% burnup
- Linear rating < 20 kW/m
- Less than 0.1% swelling per percent Pu burnu
- Gas release: < 1%
- Internal corrosion ~ 15 microns. Oxide phase observed in PIE.

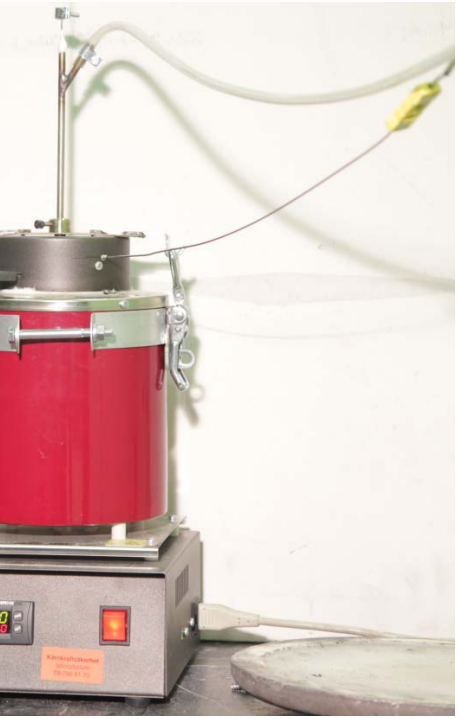


- $(Pu_{0.1},Zr_{0.9})N$ fuel fabricated by JAEA
- PuO_2 and metallic Zr source materials
- 10% initial porosity
- Irradiation in JMTR up to 15% burnup
- Linear rating: < 44 kW/m
- 0.3% swelling per percent Pu burnup
- Gas release: ~ 1.6%
- No internal corrosion



- UN powders fabricated by hydridation/nitridation of metallic source materials
- UN and (U,Zr)N pellets fabricated using spark plasma sintering (SPS) technique.
- Hot pressing assisted by 5000 A current!
- UN pellets with up to 98% density obtained when holding for 3 minutes at 1650°C.
- 90% density obtained at T = 1450°C. Permits fabrication of Pu & Am bearing nitrides.

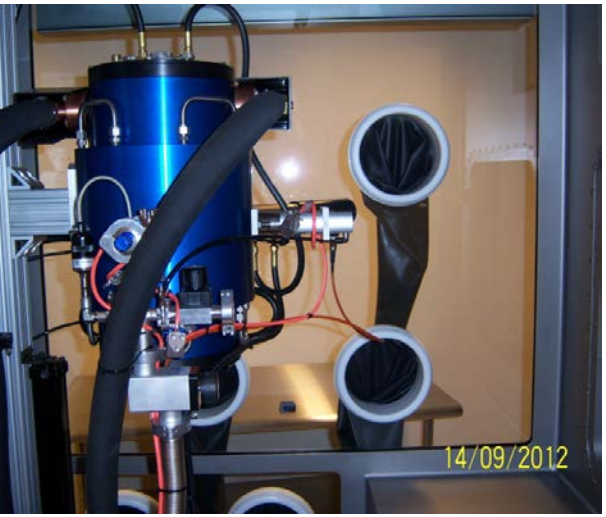
- 95% dense UN pellet was heated in argon to 1060°C
- Immersion into LBE at T < 200°C
- Cooling rate > 700 K/s
- No fracture, no cracks!

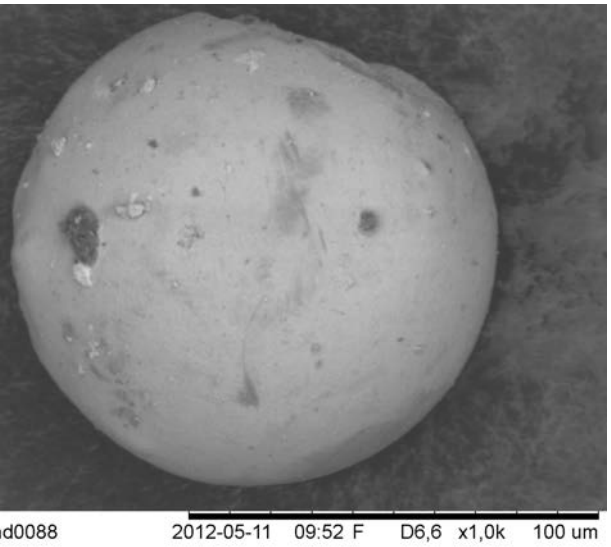


- SPS sintered UN sample tested in lead for 1 hour at T = 1090°C.
- No or small interaction under low oxygen conditions
- Significant degradation of surface observed in saturated oxygen conditions.

TALL loop at KTH

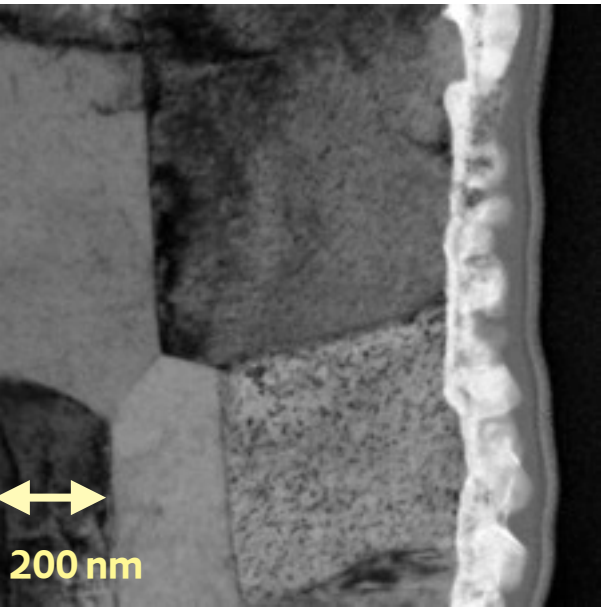
- 6 m tall LBE loop in operation since 20
- Extensively used for tests of natural convection
- Flow reversal observed under certain conditions
- Single pin heat transfer experiments conducted
- Now modified for additional heat transfer experiments





- Chalmers university has done R&D on separation of Pu and MA since 40 years
- Glove boxes for Pu fuel fabrication lab installed in September. Only university lab in Europe.
- (Pu,Zr)N fuels to be fabricated by Sol-Gel techniques (and later, from powders)
- Zirconia microspheres with homogeneous carbon nano-tube dispersions obtained in spring 2012.
- Start of hot operation: November 2012

COSTA @ KTH



Fe10Cr6Al-RE
10 000 h @ 550°C

- Stagnant corrosion facility purchased from KIT
- Reference cladding material for ELECTRA: 15-15Ti with FeCrAlY surface alloying. To be developed in collaboration with KIT & Sandvik
- New FeCrAl alloys developed by Sandvik, base on commercial FeCrAl-ODS steels.
- Sandvik materials were exposed to lead with 0. ppm oxygen at 550°C for 10 000 hours.
- Fe10Cr6Al-RE in perfect condition!
- Alumina forming austenites to be investigated.