

MATERIALS TECHNOLOGY DEVELOPMENT AT THE PETTEN HIGH FLUX REACTOR



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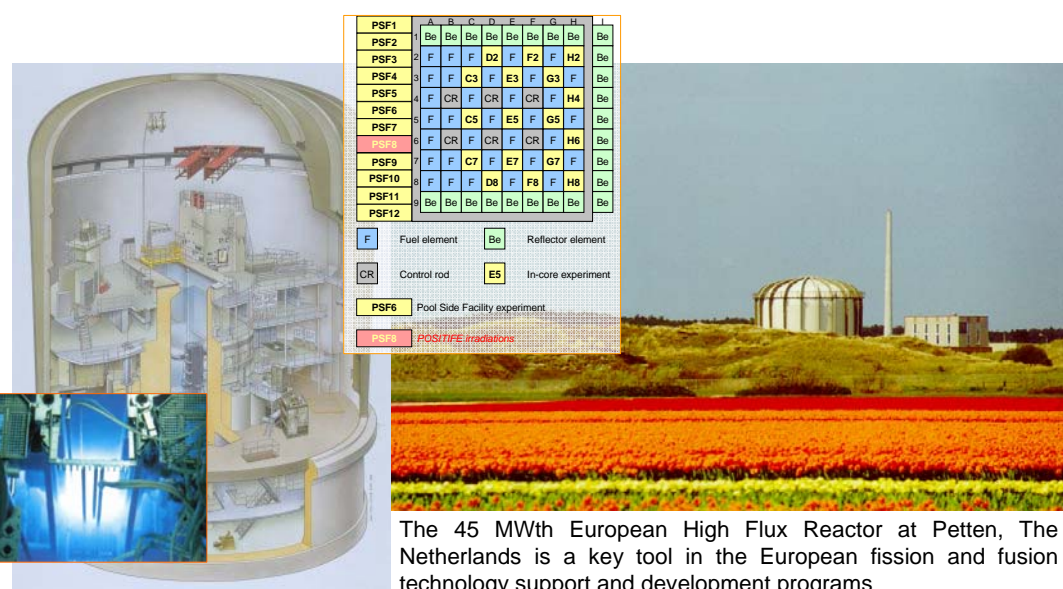
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Summary

The High Flux Reactor at Petten is for several decades a major tool in the development of Fission and Fusion Technology Programs. The HFR is a 45 MW Materials Test Reactor, and operated for about 280 Full Power Days per year. HFR's high versatility provides it with extremely relevant R&D capabilities for fission and fusion power plant technology.

The HFR contributes to the nuclear technology development by providing experimental results utilising the HFR as the neutron source and both NRG and partners hot cell laboratories to perform post-irradiation testing.

A wide variety of irradiation projects for the development of nuclear technology have been undertaken or are in progress at the HFR Petten. The work is mostly supported by the Netherlands' Ministry of Economic Affairs, with financial support from the European 6th and 7th Framework Programs on Fission and Fusion Technologies, or through 3rd Party sponsorship.



The 45 MWth European High Flux Reactor at Petten, The Netherlands is a key tool in the European fission and fusion technology support and development programs

Fusion Technology

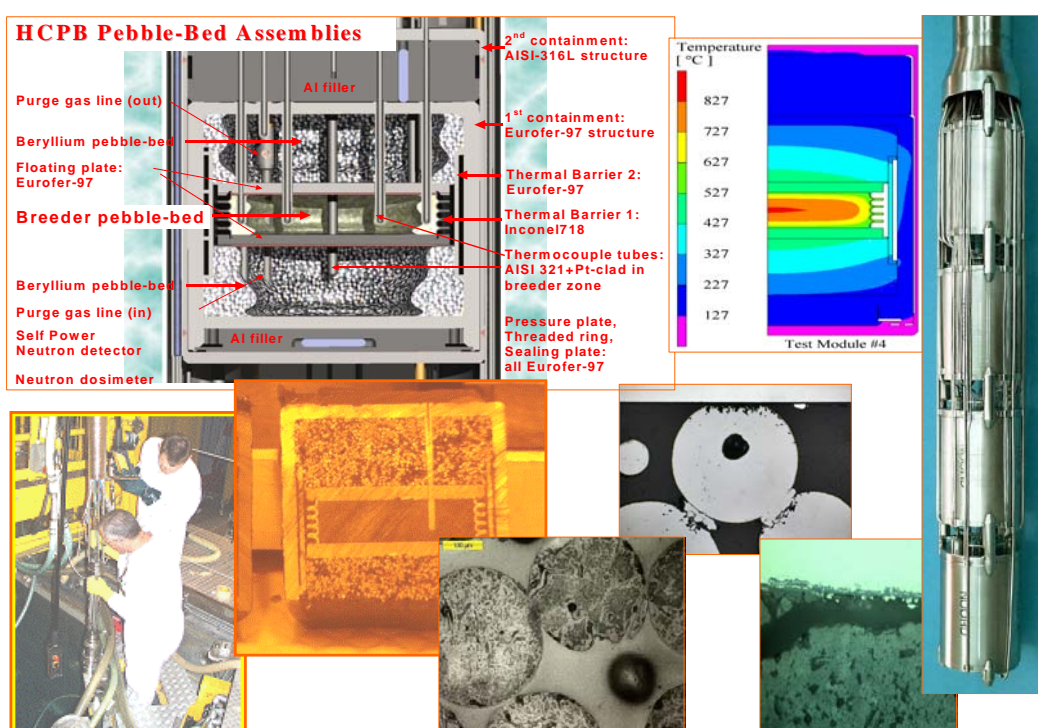


ITER Vessel/In-Vessel

- Pre-qualification of *alternative manufacturing processes* like explosive forming and cladding
- *Repair welding* studies on irradiated SS 316L(N)-IG
- Irradiation testing of *bolt materials* like PH13-08Mo and Ni-alloys
- *Primary Wall Fatigue endurance* of actively cooled first wall mock-ups - integrity of joints under repetitive thermal and neutron loads.

DEMO and ITER Test Blankets

- In-pile thermo-mechanical behaviour of HCPB blanket cut-out with essential features. Four representative *Pebble-Bed Assemblies* reached 300 Full Power Days, achieving up to 3% burn-up, with the breeder ceramic at 850-1150 K.



Fission Technology

Examples of current projects:

- Irradiation of AGR core structures graphites for British Energy Ltd : accelerated ageing under oxidising conditions – operational support & life-extension
- Core structures graphite for (Very)High Temperature Reactors: 1) design curves for present day commercial graphites, 2) post –irradiation creep of T91 & weldments for hot-vessel application
- Developmental 12-14Cr ODS ferritic steels (with EPFL/CRPP), W-armour on steel: screening tests
- In-pile tests of 9Cr steels in PbBi for transmutation target studies: compatibility/corrosion issues
- Crosscutting materials issues for Generation-4 and Transmutation projects
- Fairfuels, fabrication, irradiation and reprocessing of fuels and targets for transmutation & Gen4



Reactor Development – DEMO/FPR

Structural Materials

- Low Activation 9Cr WVTa steels, *Eurofer*
- ODS steels & W-alloys
- SiCSiC composite

Functional Materials

Includes heat-sink and plasma facing materials, windows, breeder and multiplier materials, etc. Current irradiation projects are.

- Solid breeder: EXOTIC: *3H production and release from Li-ceramics*, and HICU: *High dose irradiation of Li-ceramic pebbles, effect of tailored neutron-spectrum on pebble (stack) integrity*, up to ~20 dpa and ~10% Li-burn-up; HIDOBE: *High dose Beryllium, effect of He-bubbles on 3H-inventory and pebble-bed behavior*.
- Liquid breeder LIBRETTO: *3H production, extraction and release from liquid Pb-Li eutectic*, and 3H permeation.
- *Compatibility* of breeder and structural materials, ceramic-breeder blanket interactions
- *Coatings* for reduction of 3H permeation, anti-corrosion, in-pile oxidation processes



The Nuclear Research & consultancy Group is a member of the Sustainable Nuclear Energy Technology Platform, SNETP



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