DEVELOPMENT of NUCLEAR FUEL for RESEARCH REACTORS in CHILE

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Simposium ANS-LAS
21-25 June 2010, Rio de Janeiro

Outline

- **MTR Fuel Development, and Fabrication**

  Local fabrication, evaluation and qualification of LEU MTR type fuel

- **UMo Development Programme**

  Objectives, status, latest results

MTR Fuel Development & Fabrication

- Plant for Fuel Fabrication was commissioned in 1986 at Nuclear Centre of Lo Aguirre (30km West from Santiago) to supply fuel assemblies for Chilean research reactors

- First task was to disassemble, inspect all fuel plates and re-assemble of HEU fuel elements for Lo Aguirre RECH-2 (1987)

- Development of U-Si matrix for supporting conversion of RECH-1 to LEU and fuel plates development

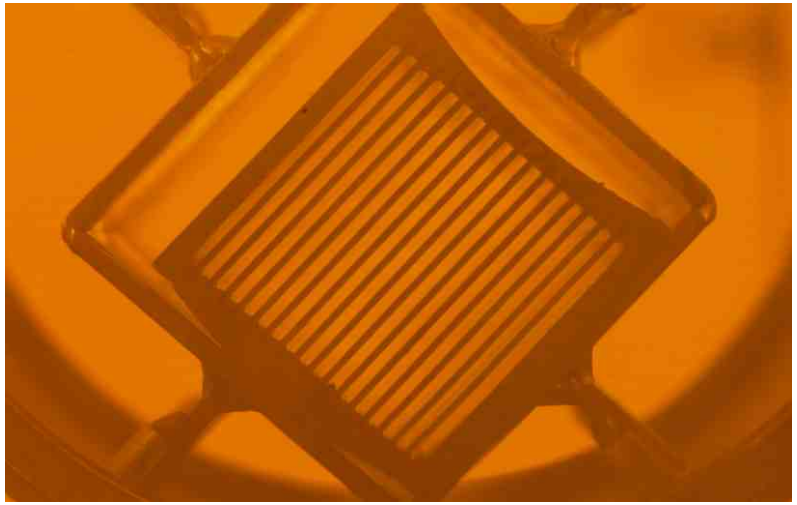
Fabrication of new LEU U_3Si_2 fuel for RECH-1: 4 leader FA`s loaded in RECH-1 (1999) and full LEU core (2006)

PIE Qualification

2002-2005 Irradiation of one LEU HD uranium FE and Post Irradiation Examination (PIE) performed at HFR-Petten, with IAEA's support.

LEU fuel element made of U_3Si_2-Al (3,4gU/cm^3) successfully irradiated up to >65% ^{235}U burn-up

Fabricated FE HFR design

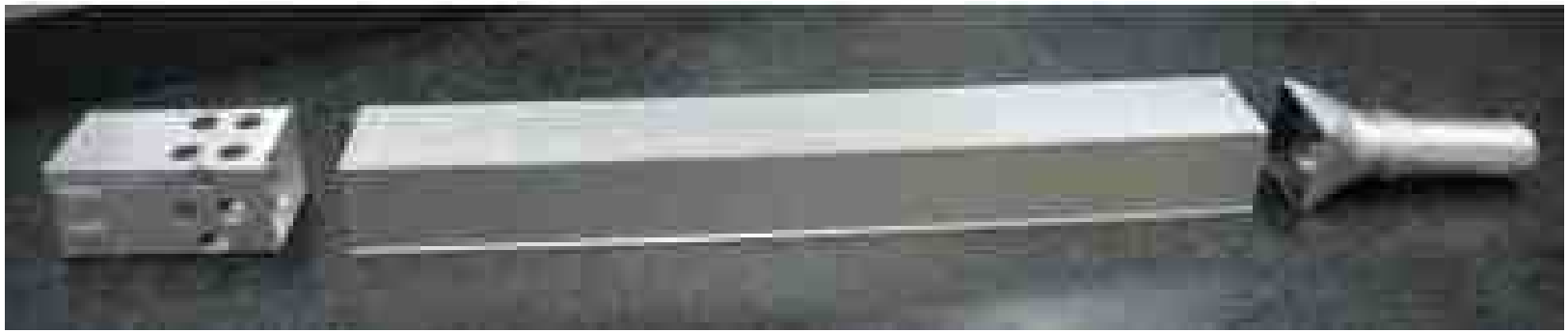


Burnt fuel at hot cell Lab.

CCHEN's Fuel Fabrication

- 48 HD LEU fuel assemblies were fabricated and assembled according to international standard and reactor technical specifications

RECH-1 Fuel Assembly Improvements



Main Structural modifications of TFE as compared to RECH-1 Standard Fuel Element:

- Modified design use a forged nozzle made of one piece;

Final assembly contents two welding filets instead three;

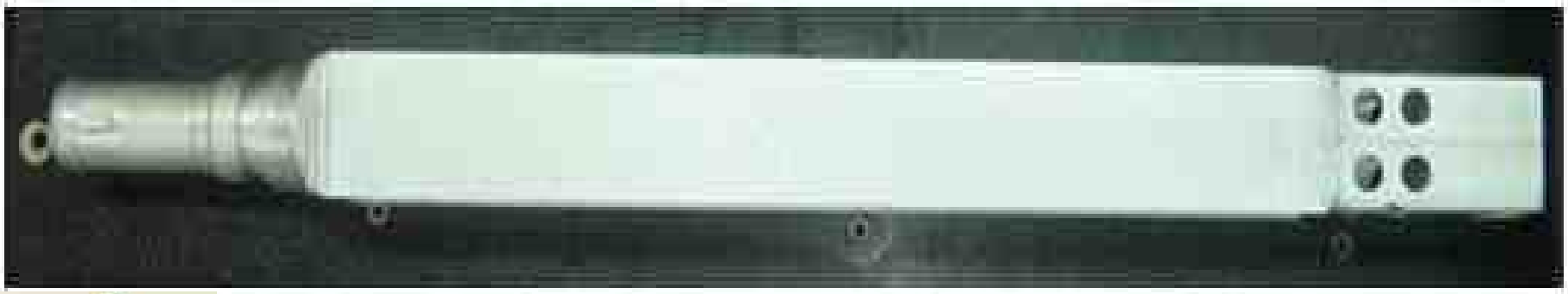
For inspection purposes: top head box has open water inlet instead of a closed box with a filter plate

Local Irradiation of HD FA

U_3Si_2 Test Fuel Element (TFE)

One LEU fuel plate U_3Si_2 ; U-density = 4,8 gU/cm^3 ; ^{235}U mass / plate = 20,19 g

TFE was loaded in the reactor core July 2007



Local Irradiation of HD FE

Irradiation started on July 12, 2007

Follow-up program during irradiation includes :

- Water Sipping test
- Visual Inspection
- Burn up measurements
- Neutron flux measurements

Cooling gap measurements:

Water quality surveillance records

Present burn-up of 9%

UMo Fuel Development

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Melting and Casting of UMo ingots

Prepared alloys: U-7 wt% Mo, U-8 wt% Mo and U-10 wt% Mo

Induction furnace controlled atmosphere chamber

UMo alloy ingot poured into graphite mould (Dourville)

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Out of pile Swelling tests

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Applied to miniplates UMo/Al modified by addition of third element dispersed in an aluminium matrix pure or with Si addition.

Before annealing

After annealing

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Monolithic U-Mo Fuel Development

Ingot casting in graphite closed mould

Flattening and cleaning of ingot through underwater machining

Monolithic U-Mo Fuel Development

UMo ingot divided in four coupons

(e=2.5mm)

UMo coupon framed in steel assembly

Y_2O_3 anti-stick white coating

UMo coupon sealed by welding in steel assembly for hot rolling

Monolithic U-Mo Fuel Development

Hot rolling of UMo coupon encapsulated in steel can

UMo foils manufactured by hot rolling (0,49 mm thickness)

Expected Goals

- Finalizing of irradiation of TFE in RECH-1 expecting b-u of >50%
- Planning for a new LEU HD U_3Si_2 (4.8 gU/cc) fuel fabrication for RECH-1, to be initialized by 2011
- Convert RECH-2 core to LEU: FA & core re-design
- To perform irradiation and PIE of UMo fuel miniplates
- To achieve international agreements (IAEA platform or coalitions) for exporting fuel
- To integrate efforts in the regional community

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Thanks For Your Attention

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