



FP7 - PELGRIMM : a new step in the oxide fuel development rationale for MA transmutation in SFR

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ID

- Project Title: **PELlets versus Granulates: Irradiation, Manufacturing & Modelling**
<http://www.pelgrimm.eu/www/pelgrimm/>
- Type: **Small/Medium Scale Collaborative Project**
- Starting date: **Jan. 2012**
- Duration: **48 months**
- Budget: **7.2 M€ including EC funding of 3M€**
- Partnership:



SCOPE

- MA-bearing oxide fuel developments for Gen-IV SFR

2 MA-recycling options:



MA homogeneous recycling:

- MA bearing Driver Fuels: $(U,Pu,MA)O_{2-x}$
- MA < 5%
- from moderate to significant impact on SFR core safety parameters and fuel cycle facilities



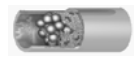
MA heterogeneous recycling:

- MA Bearing Blankets: SA of $(MA\ oxide + UO_2)$ fuel in outer core
- MA ~10-20%
- limited impact on core operating & safety parameters and dedicated MA bearing fuel cycle facilities

2 fuel shapes:

Pellets

Beads



OBJECTIVES

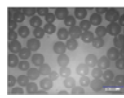
Comparison between spherepacked and pelletized MA-bearing oxide fuels

- Fabrication process developments and fuel property measurements
- Behaviour under irradiation: Post-Irradiation Examinations, one irradiation test in HFR, modelling and predictive code developments
- Core Safety performance
 - Capitalize on the efforts made within the European projects: F-BRIDGE, CP-ESFR, ACSEPT and FAIRFUELS
 - Take a next step in the long term process of the fuel qualification rationale

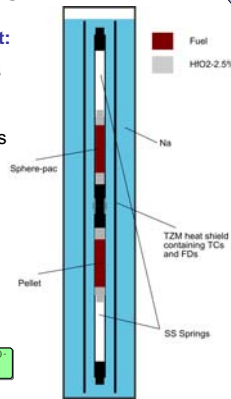
Experiments on $(U,Pu,Am)O_2$ fuels

PIE of SPHERE pins irradiated within the FAIRFUELS project:

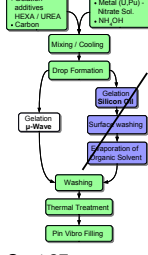
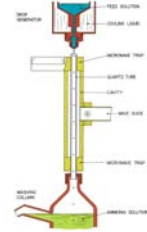
- $U_{0.77}Pu_{0.20}Am_{0.03}O_{1.98}$ particles prepared by sol-gel processes
- 2 stacks : pellets & beads (2 size fractions: 50 and 800µm)
- HFR tailored spectrum, ~280 W.m⁻¹, T_{clad} ~500°C, ~12 months



(courtesy of FAIRFUELS consortium)



Investigation of Microwave internal gelation



Details in C. Cozzo presentation on Sept.27

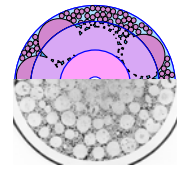
Modelling and simulation of fuel behaviour under irradiation

MA-bearing oxide fuels: $(U,Pu,MA)O_{2-x}$ & $(MA,U)O_{2-x}$

Pellets & beads



MACROS



TRANSURANUS

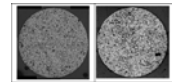
GERMINAL

SPHERE

Experiments on $(U,Am)O_2$ fuels

PIE of MARIOS pins irradiated in HFR within the project FAIRFUELS:

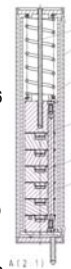
- Effects of high He production under isothermal conditions
- Details on MARIOS irradiation in E. D'Agata et al. presentation on Sept. 26
- Dense and porous disks of $U_{0.85}Am_{0.15}O_{1.94}$
- 2 temperatures: 1000 & 1200°C
- Irradiation time ~304 EFPD



(courtesy of FAIRFUELS consortium)

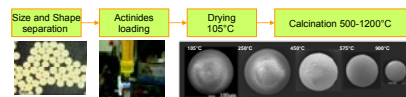
Preparation and implementation of MARINE irradiation in HFR:

- direct comparison of Am containing - beads and pellet fuel under similar condition
- $U_{0.85}Am_{0.15}O_{2-x}$
- 2 pins : stacks of pellets & beads (2 size fractions), Phenix cladding
- Irradiation conditions under definition : ≥360 EFPD, on-line pressure measurement, ...



Weak Acid Resin technology investigation for beads fabrication:

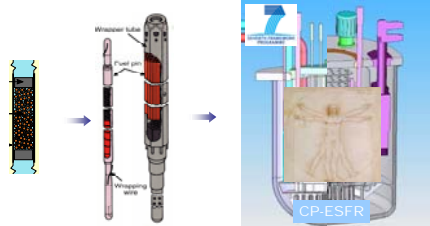
- alternative route to sol gel-infiltration methods using an organic template of ionic exchange resin beads



(S. Picart, E. Remy et al., ATALANTE 2012)



Safety performance preliminary assessment of a core loaded with spherepacked MA-bearing fuels



Core design

- Performance in normal operation conditions, and transients from Design Basis Conditions and Design Extension Conditions

Education & training

Placement of trainees in organisations involved in PELGRIMM

- 8 trainees of Master degree during 6 months for contributions to RTD actions within the project

Grants to young people (PhD, Post-Doc, ...)

- to support participations to training courses, summer schools, conferences, workshops, ...