



FIRST FREDMANS TRAINING SESSION ON NUCLEAR FUEL

Venue: Institute for Nuclear Research, Pitesti – Mioveni, Romania

25 – 29 September 2023

Programme

September 25, 2023

Day 1: Fuel characteristics and performances requested for an LFR reactor (10:00 – 17:00)

(1h) 10:00 – 11:00	Introduction to the desired characteristics of a fuel for an LFR - Overview of most commonly employed fuel forms for FRs	Francesco Lodi (ENEA)
(1h) 11:00 – 12:00	MOX fuels: Introduction Fuel performance in-core (mentions vs. LWR)	Francesco Lodi (ENEA)
0.5h	Coffee break	
1 h 12:30 -13:30	Nitride fuels: Introduction Fuel performance in-core (mentions vs. MOX)	Janne Wallenius (LeadCold)
13:30 -14:30	Lunch	
(1h) 14:30 -15:30	MOX doped with MA: New challenges relative to standard MOX	Simone Gianfelici (ENEA)
0.25h 15:45 -17:00	Coffee break Interactive exercise: Designing a FR fuel pellet encompassing MOX and Nitrides form	Francesco Lodi (ENEA)

September 26, 2023

Day 2: Nuclear fuel fabrication (9:00 - 17:00)

(1h) 9:00 – 10:00	Nuclear fuels for existing and future reactors	Daniela Diaconu (RATEN)
(1h) 10:00 – 11:00	Oxides fuel fabrication - Fabrication flux - Chemical processes in UO ₂ powder fabrication	Iulia Dumitrescu (RATEN)
0.5h	Coffee break	
1 h 11:30 -12:30	Oxides fuel fabrication (cont) - Physical processes in UO ₂ pressing and sintering	Daniela Diaconu (RATEN)
12:30 -13:30	Lunch	
(1h) 13:30 -14:30	Irradiation effects in nuclear fuel	Marin Mincu (RATEN)
0.5 h 15:00 -16:30	Coffee break Nitrides fuel fabrication - Techniques used for UN fabrication - Chemical processes involved - Advantages and drawbacks	Manuel Pouchon (PSI)
16:30 -17:00	Q&A	All

September 27, 2023
Day 3: Nuclear fuel characterisation (9:00 – 17:00)

(1.0h) 9:00 – 10:30	Advanced fuel manufacturing techniques	Manuel Pouchon (PSI)
(1.5h) 10:30 – 11:30	Fresh nuclear fuel characteristics <ul style="list-style-type: none"> - Powder characteristics: <ul style="list-style-type: none"> o density, porosity and pore distribution; o granulometry; isotope composition, impurities, stoichiometry - Sinterability test - Sintered pellet characteristics (density, porosity, grain size, microstructure, ...) 	Daniela Diaconu Iulia Dumitrescu Mariana Postelnicu Livia Stoica (RATEN)
0.5 h	Cofee break	
(1.5h) 12:00 – 13:30	Irradiated fuel characterisation <ul style="list-style-type: none"> - Fission gas pressure and fission gas release rate; - Fission products distribution - Burn-up - Microstructure 	Marin Mincu (RATEN)
1h	Lunch	
(1.0h) 14:30 – 16:00	Scientific visit: Fuel Fabrication Plant (FCN)	
(1.0h) 16:00 – 17:00	Scientific visit: Hot Cells Facility	

September 28, 2023
Day 4: Hands on training on fuel fabrication and characterisation (9:30 – 17:00)

0.5h 9:30 – 10:00	Radioprotection aspects in nuclear fuel fabrication	Cristian Dulama (RATEN)
(1.0h) 10:00 – 11:00	Equipment used in fuel fabrication	Visit of fuel manufacturing laboratory
0.5 h	Cofee break	
(1.0h) 11:30 – 12:30	Hands on training on characterisation techniques (1st part) <ul style="list-style-type: none"> - Pellets density determination - Grain size determination (sample preparation and metalographic investigation); - Microstructure analysis (SEM); 	Mariana Postelnicu Livia Stoica Livia Stoica (RATEN)
1h	Lunch	
13:30 – 16:00	Hands on training on characterisation techniques (2nd part) <ul style="list-style-type: none"> - Practical applications 	
16:00 – 17:00	Results presentation and discussion	

September 29, 2023
Day 5: Verification

9:00 – 13:00

(1.5h)	Q&A and final discussions
(1.5h)	Verification
(0.5h)	Coffee break
(0.5h)	Awarding of diplomas

Lecturers:

Dr. Francesco Lodi, ENEA, Italy
Dr. Janne Wallenius, LeadCold, Sweden
Dr. Simone Gianfelici, ENEA, Italy
Dr. Manuel Pouchon, PSI Suisse
Dr. Daniela Diaconu, RATEN, Romania
Dr. Iulia Dumitrescu, RATEN, Romania
Dr. Marin Mincu, RATEN, Romania
Dr. Cristian Dulamă, RATEN, Romania
Dr. Livia Stoica, RATEN, Romania
Mariana Postelnicu, RATEN, Romania