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FIRST Nuclides

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FIRST-Nuclides News

In this issue:

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www.firstnuclides.eu

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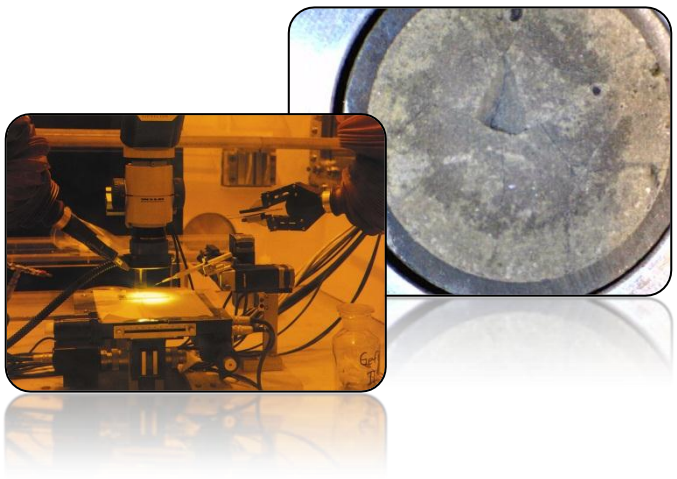
About FIRST-Nuclides

The Collaborative Project "Fast / Instant Release of Safety Relevant Radionuclides from Spent Nuclear Fuel (FIRST-Nuclides)" started in January 2012 and extends over three years. It falls within the European EURATOM (European Atomic Energy Community) program and is implemented within the European Commission's 7th Framework Program.

The project consortium consists of 10 Beneficiaries from large Research Institutions and SME's from 7 EURATOM Signatory States, and the EC Institute for Transuranium Elements. National Waste Management Organizations contribute to the project by participation in the End-User Group, by co-funding to Beneficiaries, and provide for knowledge and information.

The overall objective of the FIRST-Nuclides project is to provide for improved understanding of the fast / instantly released radionuclides from disposed high burn-up UO_2 spent nuclear fuel.

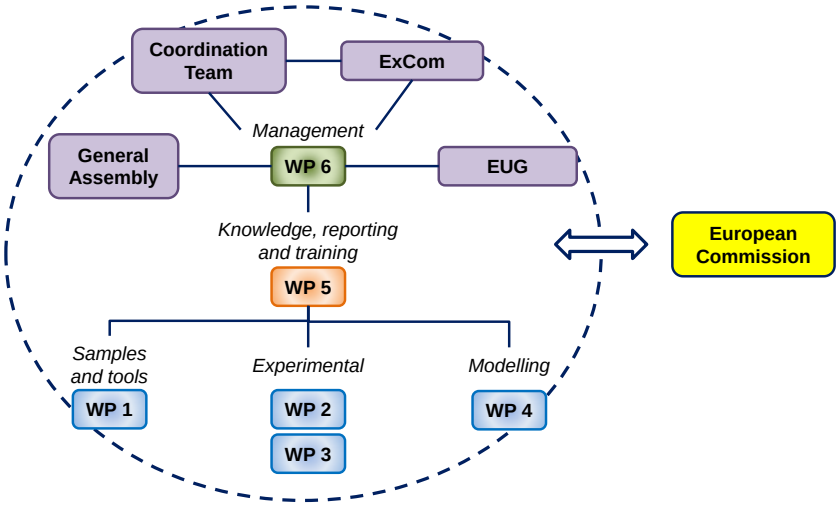
Coordinator: Bernhard Kienzler and Volker Metz (Karlsruhe Institute of Technology, KIT)
Scientific-Technical Secretariat: Lara Duro and Alba Valls (Amphos 21)



1st Annual Newsletter

The main objective of the Annual Newsletters is to inform the broader community on the progresses achieved within the FIRST-Nuclides project. The present newsletter gives a brief overview of the activities carried out during the first year of the project.

FIRST-Nuclides organization

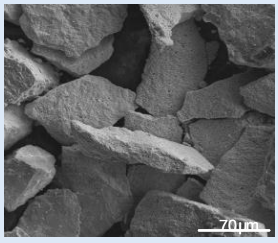


The FIRST-Nuclides Project is structured along four Research and Technical work packages (WP1 to WP4). WP1 focuses on the selection and preparation of samples and tools. WP2 and WP3 are oriented to experimental research and WP4 develops the modelling task. In addition, specific work packages on knowledge, reporting and training (WP5) and administrative management (WP6) are included in the project.

Task overview

• *WP1: Samples and tools*

The main objective of WP1 is the selection, characterization and preparation of materials and set-up tools. 9 beneficiaries are working in this workpackage. The specific goals are (i) Provision of available experimental & theoretical data on high burn-up spent nuclear fuel (HBU-SNF) material (ii) Preparation of selected HBU-SNF samples for characterization and experimental investigations within WP2 and WP3 (iii) Structural and chemical characterization of HBU-SNF samples (iv) Documentation of available experimental and theoretical data in addition to results of the characterization of the selected samples.



Spent fuel sample

KIT is the leading organization and coordinates the selection of appropriate HBU-SNF materials. KIT will also provide spent fuel data.

JÜLICH and **STUDSVIK** will provide data on fuel history, irradiation characteristics and radionuclide inventories of HBU-SNF materials in their stocks.

SCK·CEN will assess manufacturing and operational data of HBU-SNF in the SCK·CEN stocks.

WP leader: Volker Metz (KIT)

JRC-ITU and **PSI** will compile data on manufacturing and operational data of HBU-SNF in their stocks.

CTM will perform the characterisation of HBU-SNF material which will be used in consecutive experiments in WP3

CNRS will set-up an irradiation cell for microscopic studies of corrosion at grain boundaries of UO_2 under cyclotron radiation.

EK will compile manufacturing and operational data on VVER fuel rods stored in water for several years.

• WP2: Gas release + rim and grain boundary diffusion

The overall objectives of WP2 are the quantification of fission gases and fission gas release in the various HBU-SNF and rim and grain boundary diffusion experiments. Diffusion experiments will result in the quantification of water penetration into the grain structures and subsequent corrosion/diffusion phenomena, the evaluation of corrosion rates with samples with and without grain boundaries and the quantification of the specific role of radiolytically produced H_2 gas on the fast release fraction. Five institutions are working to achieve WP2 objectives.

KIT will determine fission and activation products in (i) the gas phase from a punctured fuel rod segment (ii) sample solutions from leaching experiments and (iii) gas phase from leaching experiments

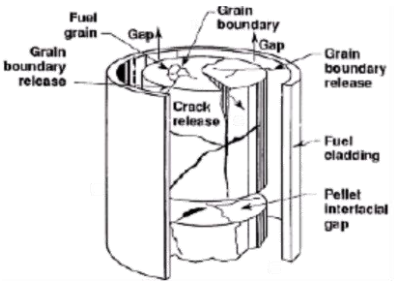
STUDSVIK will use Laser-Ablation Mass Spectroscopy for determination of radial fission gas distribution (Xe, Kr,) as well as I, and Cs.

CNRS will investigate the role of grain boundaries by dissolution experiments and the role of H_2.

JRC-ITU is the leading organization for WP2. JRC-ITU will quantify fission gases inventory and will study water penetration into UO_2 fuel under disposal conditions

JÜLICH will determine the microstructure and the elemental distributions of the fuel samples before and after and the radionuclide inventory in the fuel kernel and in the coatings.

WP leader: Detlef Wegen (JRC-ITU)



Scheme of fuel structure and main radionuclide release ways

• WP3: Dissolution based release

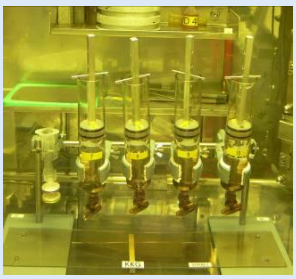
The goals of the WP3 are the quantification of the fast release of gaseous and non-gaseous activation and fission products into aqueous phase SNF leach tests and the determination of the speciation of leached isotopes. Results obtained in this workpackage will be the input for WP4 which will model the experimental data. This task is carried out by seven institutions.

KIT will perform short-term leaching experiments under anoxic conditions in autoclaves in low ionic strength solutions.

PSI will determine the IRF from two different fuel types for the nuclides ^{129}I, ^{14}C, ^{137}Cs and ^{79}Se by means of leaching experiments.

JRC-ITU will leach different parts of the fuel separately: From the centre and the rim of a pellet in bicarbonate solutions.

SCK·CEN is the work package leader. SCK·CEN will perform leaching tests on fuel fragments and apply (radio)chemical analysis of the solutions and surface analyses of the leached fuel samples



Experimental set-up

CTM will carry out leaching test with different kind of samples to study fast release fraction of ^{129}I, ^{135}Cs, ^{126}Sn, ^{79}Se and ^{99}Tc.

STUDSVIK will provide IRF values of Cs, I, Se and ^{14}C as well as Se(IV/VI) speciation.

EK will determine dissolution rates for different isotopes and uranium using activity concentration data from wet storage of damaged and leaking fuel.

WP leader: Karel Lemmens (SCK·CEN)

• WP4: Modelling

Spent fuel pellet after irradiation

WP4 is focused on the modelling of migration/retention processes of fission products in the spent fuel structure. The specific objectives are: (i) initial speciation of rare fission products inn LWR fuel, (ii) multi-scale modelling of the migration/retention processes of FP in the HBU-SF and (iii) estimation of the fission product total release through the spent fuel rod. Four institutions are actively working to achieve the mentioned objectives.

KIT will use thermodynamic approaches to obtain the initial speciation on ^{14}C and other fast release elements as a function of irradiation history, temperature, etc.

AMPHOS21 will model the migration of fission gases and nongaseous fission products in the different microstructure zones in the spent fuel pellet.

JRC-ITU will provide information on existing modeling tools, methods, and data bases at JRC-ITU.

CTM is the WP leader and will develop improved models to predict the fission gas releases.

WP leader: Joan de Pablo (CTM)

• WP5: Knowledge, reporting and training

Website of the FIRST-Nuclides Project (http://www.firstnuclides.eu/)

The main objectives of WP5 are to provide (i) access to all scientific-technical results for all interested parties and (ii) training and education for the next generation of spent nuclear fuel specialists. Different communication tools will be used to achieve the mentioned goals. Some examples of those tools are: development of a WEB portal for the project, organization of three annual workshops, preparation of proceedings, edition of annual newsletters or organization of training courses.

AMPHOS21 is the leader of this WP and will conduct the main activities with respect to dissemination and training.

All partners will contribute to the activities

WP leader: Alba Valls (AMPHOS21)

Events

• *'Kick-off' meeting*

The 'kick-off' meeting was held in Barcelona (Spain) on the 9th-10th February 2012. The meeting was hosted by Amphos21. In association with this event, meetings of the different project consortium bodies (Executive Committee, General Assembly, End-User Consultancy Group) took also place.

In total 45 persons attended the meeting including: beneficiaries (32 participants), associated groups, EUCG's members and external participants.

The main purpose of the 'kick-off' meeting was to ensure that all participants agreed on the aim of the project, how it is organized, the expected contributions of each part and other issues related with the progress of the project.

• *1st Annual FIRST-Nuclides Workshop*

The forthcoming 1st Annual Workshop is under preparation. It will be held in Budapest (Hungary) 9th-11th October 2012. The workshop will be hosted by EK.

This first annual workshop aims at giving an overview of the status of the project to internal and external participants. An insight of the activities related with the project and the achievements within it will be also provided.

Meetings of the Executive Committee, the General Assembly and the End-User Consultancy Group are held within the context of the Workshop.

A topical session is planned for this workshop dealing with issues of concern for the FIRST-Nuclides field.

The flyer with main information about the meeting is distributed among the project partners and uploaded to the internet website, accessible for any interested party.

(www.firstnuclides.eu).

Flyer of the FIRST-Nuclides 1st Annual Workshop

FIRST-Nuclides Partners

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