

MOBILITY MISSION REPORT

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KLIKNĚTE NEBO KLEPNĚTE SEM A ZADEJTE TEXT.

MISSION TITLE

Migration conference 2023

DESCRIPTION

Concerned organisations

Research entities: SCK CEN

Concerned infrastructures or facilities

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Concerned phases

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Themes and topics

Theme 1: Aquatic chemistry of actinides and fission products

- Solubility and dissolution
- Solid solution and secondary phase formation
- Complexation with inorganic and organic ligands
- Redox reactions and radiolysis effects
- Solid-water interface reactions

- Colloid formation
 - Experimental methods
 - Computational chemistry
- Theme 2: Migration behaviour of radionuclides
 - Sorption/desorption phenomena in dynamic systems
 - Diffusion and other migration processes
 - Colloid migration
 - Effects of biological and organic materials
 - Field and large-scale experiments
 - Natural analogues
- Theme 3: Geochemical and transport modeling
 - Data selection and evaluation
 - Coupling chemistry and transport
 - Development and application of models
 - Model validation
 - Safety assessment and repository concepts
- Theme 4: Application to case studies
- Theme 5: Special sessions
 - CIGEO and NORM

Keywords

Coupled diffusion and reaction; radionuclide transport; redox phenomena; solid/water interface

EXECUTIVE SUMMARY

The proposed mobility action involved attending the 18th international conference on the chemistry and migration behaviour of actinides and fissure products in the geosphere, which was held in Nantes, France. The main objective was to present the modelling and experimental results on the interaction between nuclear waste glass and cement, which is the part of the work for the EURAD-ACED project. This was a very compact conference with a lot of presentations from Europe, the US and Asia. The topics mostly center around the migration or the chemistry of radionuclides in clay or cement environments from both modelling and experimental perspectives. There was also a session dedicated to the evolution of waste programs and impact on research chaired by B. Grambow and G. Montavon. There were a lot of interesting presentations about modelling. Just to name a few here: C. Tournassat gave a presentation on modelling electrostatic interactions at clay mineral surface; J. Poonoosamy gave a presentation on modelling transport-induced co-precipitation and radionuclide retention; M. Delcroix gave an introduction of his Ph.D during which he will use GRAAL2 to model glass dissolution at different pH values. I had some discussions with them during the conference. With C. Tournassat we discussed about how to handle precipitation for modelling electrostatic interaction at clay surface. With Poonoosamy we discussed about the kinetic precipitation rate in her model. With Delcroix we talked about the potential application of GRAAL2 model for alkaline conditions. In summary, this was a very informative conference with a lot of interesting talks and fruitful discussions.

1. MISSION BACKGROUND

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1.1. R&D background

The MIGRATION conferences provide an international forum for the timely exchange of scientific information on chemical processes controlling the migration behaviour of actinides and fission products in natural aquifer systems. Experimental investigation and predictive modelling of these processes are the main topics of the conferences. The information generated from the MIGRATION conferences is the basis for the mechanistic understanding of the migration behaviour of long-lived radionuclides in the geosphere, which is essential for the long-term performance assessment of nuclear waste disposal.

1.2. Mission objectives

To present the modelling and experimental results on the interaction between nuclear waste glass and cement, which is the part of the work for the EURAD-ACED project.

1.3. Mission request

Migration conference 2023

1.4. Mission composition

Host organisation

SUBATECH, France

Host facility

Cite des Congres, Nantes, France

Mission dates

24 September 2023 – 29 February 2023

2. MAJOR PRACTICES, TECHNIQUES, METHODS, TOOLS OR SYSTEMS OPERATED OR STUDIED

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2.1. Practice, technique, method, tool or system operated or studied during the mission

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Description

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Usage

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Benefits

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Limitations

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Applicability

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Limitations

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Applicability

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3. MISSION FINDINGS AND CONCLUSIONS

3.1. Lessons learned and conclusions

The poster from N. Watanabe titled “Effects of alteration by leaching on migration of cesium in Hardened cement paste” shows some interesting results. The authors studied the diffusion behaviour of Cs(137) in an unaltered hydrated cement paste and NH₄NO₃ leached cement. Even though the NH₄NO₃ leached cement shows a considerable increase in porosity, the apparent diffusion coefficient in the NH₄NO₃ leached cement is lower due to a stronger Cs sorption. No sorption of Cs onto the unaltered cement was observed. This clearly indicates the presence of secondary phases in the NH₄NO₃ leached cement which contributes to Cs sorption. Our geochemical modelling results for bitumen/cement interaction have already shown that the secondary phase might be mononitrate.

In the poster from P. Chen titled “Reactive transport modelling of TcO₄⁻ diffusion in opalinus clay with PFLOTRAN”, the authors apply a different diffusion coefficient for TcO₄⁻ from all the other diffusing species, which might indicate the Nernst Planck equation has already been implemented in PFLOTRAN or a modified version of PFLOTRAN (to be checked).

In talk from R. Ewing titled “Safety and Science: the fragile connection-Part 2”, the speaker concluded that despite decades of research at huge cost, the field of radioactive waste management and disposal has not, by and large, capitalized on this research in the development of a basic understanding of key issues that dominate the safety case. There is a tension between the sciences of near-field processes and performance assessments. Waste form research should be developed as “another line of evidence” as a complementary safety argument instead of mainly relying on dilution and sorption in the far-field to meet regulatory requirements.

3.2. Relevant findings and conclusions for home organisation

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3.3. Relevant findings and conclusions for host organisation

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3.4. Relevant findings and conclusions for other organisations

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4. POTENTIALS FOR IMPROVEMENT OR DEVELOPMENT

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4.1. Generic potentials

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4.2. Potentials for home organisation

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4.3. Potentials for host organisation

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APPENDICES

Mission journal

Sunday 24th of September:

Left Mol train station at 7:30 and arrived at Hotel at about 21:30 due to the TGV delay.

Monday 25th of September:

Registration and attendance of the meeting. The meeting started at 8:30.

Session 1: computational chemistry

Session 2: Solid-water interface reactions

Session 3: Effects of biological and organic materials

Session 4: Development and applications of models: machine learning

Session 5: Poster session (19:00 ~22:00)

Tuesday 26th of September:

Session 6: Coupling chemistry and transport

Session 7: Experimental methods

Session 8: Solubility and dissolution

Session 9: Application to case studies

Session 10: Poster session

Wednesday 27th of September:

Session 11: Solid-water interface reactions

Session 12: Redox reactions and radiolysis effects

Excursion (from 13:30 to 22:00)

Thursday 28th of September:

Session 13: Diffusion and other migration processes

Session 14: CIGEO

Session 15: NORM

Session 16: Complexation with inorganic and organic ligands

Friday 29th of September:

Session 17: colloids

Session 18: Solid-water interface reactions: experiments and modelling

Left the conference for Nantes train station at 11:00 and arrived at Mol at 17:00.

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MISSION BENEFICIARY

Sanheng LIU
 Scientific collaborator
 Engineered and Geosystems Analysis unit
 Belgian Nuclear Research Centre SCK CEN, Belgium

PARTNER EXPERTS CONTRIBUTING TO THE MISSION

Host organisation experts

- Klikněte nebo klepněte sem a zadejte text.

Home organisation experts

- Klikněte nebo klepněte sem a zadejte text.

Other organisations experts

- Klikněte nebo klepněte sem a zadejte text.

REPORT APPROVAL

Date	Beneficiary	Home mentor/supervisor	Host mentor/supervisor
Date of last signee	Sanheng Liu	Diederik Jacques	Name
			Visa