

Feedback from previous training sessions

“The course provided an overview of many of the issues concerning in-service Zr alloys”

AECL Canada, 2013

“The course was very well presented. It was clear that a lot of effort went into presenting a comprehensive story of Zr alloys in nuclear applications”

CIEMAT Spain, 2011

“The lectures are clearly experts in their field and were able to clearly present these complicated topics”

“I am very grateful for the effort you made in organizing the course, and look forward to send future new members of our team to future courses”

JAEA Japan, 2009

85 scientists trained since 2008 coming from 15 countries (CENTRALES NUCLEARES ALMA Spain, NATIONAL NUCLEAR LABORATORY Britain, INDUSTRIAS NUCLEARES Brazil, US NUCLEAR REGULATORY USA, VROM INSPECTORATE Germany, UJP PRAHA Czech Republic, AREVA France, CANDU Canada, POSTECH Korea...)

The averaged satisfaction rate is ~85%.



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General and Nuclear Materials Department coordinators - CEA Saclay

Jean-Luc BECHADE - DEN-DANS/DMN/SRMP
Jean-Christophe BRACHET - DEN-DANS/DMN/SRMA
Bat. 453 - PC N°46
Gif-sur-Yvette F-91191
☎: +33 1 6908-5616
email: jean-luc.bechade@cea.fr
email: jean-christophe.brachet@cea.fr

Coordinator for the National Institute for Nuclear Science and Technology (INSTN) - CEA Saclay

Nihed CHAÂBANE - INSTN/UES
Bat. 395 - PC N°35
Gif-sur-Yvette F-91191
☎: +33 1 6908-8603
email: nihed.chaabane@cea.fr



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8th INTERNATIONAL TRAINING SESSION

Metallurgy and Properties of Zr Alloys for Nuclear Applications



Polarized light optical microscopy of the prior- β structure (CEA/DMN/SRMA)

June 12 – 16, 2017

INSTN – CEA Saclay, France

WHY?

To train qualified engineers, scientists and PhD students by giving a general view of Zr alloys from the processing to in service properties including safety concerns:

- By highlighting the main processing parameters affecting the as-received material properties.
- By providing a comprehensive approach on the relationship between the microstructure evolution and the physico-chemical and mechanical properties:
 - Under irradiation
 - During corrosion, oxidation and hydriding in light water reactors environment
 - Under accidental scenarii
- By giving reactor feedback and next future trends.

Presentation will focus on Zr alloys used in PWR .

YOUR CURRICULUM

- Scientists, engineers and technicians in charge of fabrication, characterisation, application and safety evaluations of Zr based components for nuclear purposes.
- Students carrying out specialised studies on materials science and nuclear engineering.

Duration and dates: June 12 - 16, 2017

Registration deadline: May 25th, 2017

Language: English

Prices: General participant: 2570 €
Student: 1800 €

Includes: attendance of the week school, lunches and any travelling on site.

Course location: Courses are held in France, at the INSTN, CEA-Saclay (20 km South of Paris).

Part 1 Introduction and Fabrication of Zr alloys

- Presentation of the lectures.
Jean-Luc Béchade and Jean-Christophe Brachet (CEA)
- Processing and forming of industrial components.
Pierre Barberis (AREVA NP / CRC)
- Basis of mechanical behaviour of Zr alloys
Anne-Françoise Gourgues and Jérôme Crépin (MINES ParisTech)

Part 2 Alloys: Structure and anisotropy

- Phase diagrams (includes Zr-H and Zr-O) and control of microstructures (in Zry and Zr-Nb).
Caroline Toffolon (CEA)
- Anisotropy, deformation mechanisms, texture development, mechanical properties.
Jean-Luc Béchade (CEA)

Part 3 Behaviour under irradiation

- Irradiation effects. Effects on microstructure. Creep and growth.
Fabien Onimus (CEA)
- Mechanical behaviour after irradiation.
Fabien Onimus (CEA)
- Corrosion in water (without and under irradiation).
Philippe Bossis (CEA)

Part 4 Accidental and Post irradiation behaviour

- Impact of H Pick-up: Embrittlement, RIA, post irradiation creep.
Martine Blat (EDF – R&D)
- Pellet-cladding interaction (PCI) components.
Antoine Ambard (CEA)
- Technical visit of Hot Cells facilities (LECI Laboratory) , CEA-Saclay

Part 5 Design base accident (RIA & LOCA)

- RIA clad behaviour
Matthieu Le Saux (CEA)
- LOCA behavior and Enhanced Accident Tolerant Fuel Claddings.
Jean-Christophe Brachet (CEA)

Session evaluation

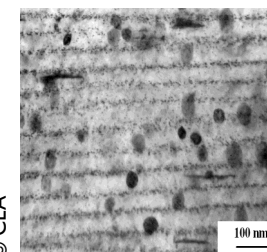
- Session evaluation and feed-back.
- *Nihed Chaâbane (CEA)*

- Lectures given by PhD professionals experts fom CEA, MINES ParisTech, EDF, Areva in Nuclear Materials Sciences
- Visit of Hot Cells facilities (LECI Laboratory) at the CEA - Saclay



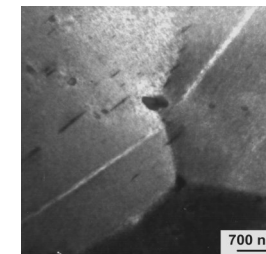
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Line M constituted with 19 hot cells for surface characterization.



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Fine precipitation in irradiated M5™ alloy/ TEM observations.



Dislocation channeling in a deformed irradiated Zy-4.

Registration

www-instn.cea.fr

Nadia Nowacki
Tel: +33 1 69 08 30 92
Fax: +33 1 69 08 77 82
email: nadia.nowacki@cea.fr

National Institute for Nuclear Science and Technology (INSTN)

CEA Saclay - Gif-sur-Yvette F-91191