



GLOBAL 2011
Makuhari, Japan
Dec. 11-16, 2011

J-ACTINET Activities of Training and Education for Actinide Science Research

K. Minato¹, K. Konashi², H. Yamana³, S. Yamanaka⁴,
S. Nagasaki⁵, Y. Ikeda⁶, S. Sato⁷, Y. Arita⁸,
K. Idemitsu⁹, and T. Koyama¹⁰

¹Japan Atomic Energy Agency, ²Tohoku University, ³Kyoto University,
⁴Osaka University, ⁵The University of Tokyo, ⁶Tokyo Institute of Technology,
⁷Hokkaido University, ⁸University of Fukui, ⁹Kyushu University,
¹⁰Central Research Institute of Electric Power Industry



Outline

- Introduction
- Actinide Science
 - » Basis of innovative nuclear technology
 - » Special facilities for research
- Japan actinide network: J-ACTINET
 - » Objectives
 - » Training through research program: ACTILAB
 - » Training and education program: ACTITRAIN
- Summary and further challenges

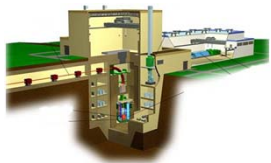
- In the field of nuclear science and technology
 - » Nuclear reactors and facilities for radioactive materials are inevitable for the training and education
 - » However, many of the reactors, critical assemblies and facilities have been shut down
- For the past several years, the competitive funds for the training and education programs in the field have been provided by the Ministries in Japan
 - » Many initiatives and programs have been carried out with these funds
- Actinide science is important in the field of nuclear science and technology



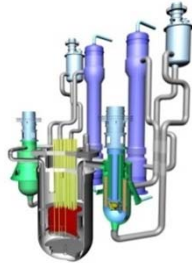
Actinide science (1/2)

Basis of innovative nuclear technology

Partitioning & Transmutation



FBR



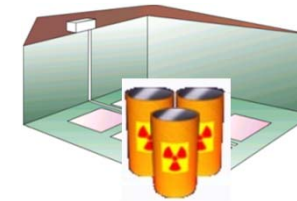
Reprocessing/
Fuel fabrication



LWR



Waste disposal

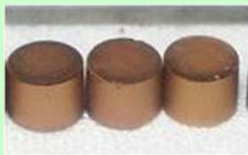


HTGR



Actinide science research

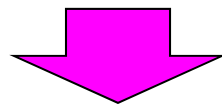
- A frontier of materials science and solid state physics and chemistry
- Indispensable to maintain sustainable development of innovative nuclear technology, especially advanced fuels, partitioning and geological disposal



Actinide science (2/2)

Special facilities for research

- Actinide elements are gamma, alpha and neutron emitters
 - » Special facilities are needed for handling
 - » Several restrictions are imposed
- Extra costs and efforts are needed to maintain the special facilities
 - » The number of the facilities has been decreased, especially in universities



- Under this condition students and graduate students have fewer chances to come into contact with actinide science research

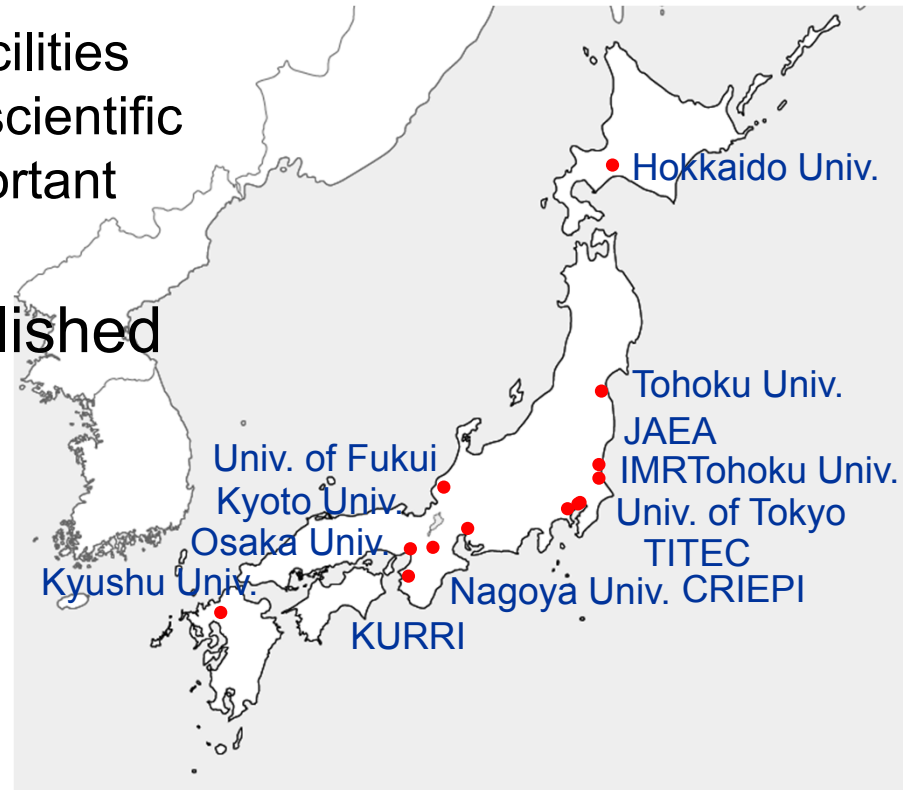




J-ACTINET Japan actinide network

J-ACTINET

- To promote and facilitate actinide science research
 - » Close cooperation with the facilities and sharing of technical and scientific information must be very important and effective
- J-ACTINET has been established since March 2008
 - » Involving 8 universities and 2 research institutes
 - » After the successful project ACTINET in Europe





J-ACTINET (1/2)

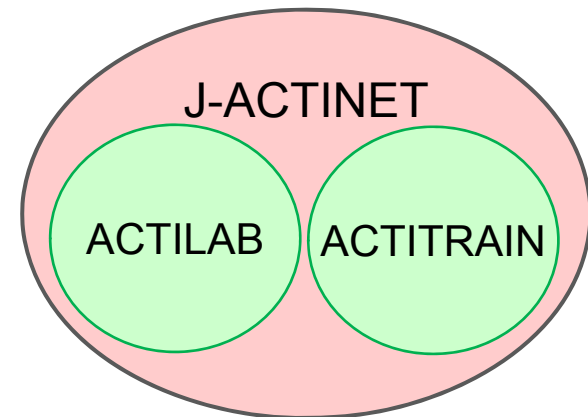
Objectives

-
- To promote and facilitate actinide science research in close cooperation with the facilities
 - To foster many young scientists and engineers to be actively engaged in the fields of actinide science
 - To provide opportunities to come into contact with actinide science research
 - To cooperate with different research fields to apply the most advanced experimental tools and computational science to actinide science research

- Training through research program: *ACTILAB*
 - » “Basic actinide chemistry and physics research in close cooperation with hot laboratories: ACTILAB”

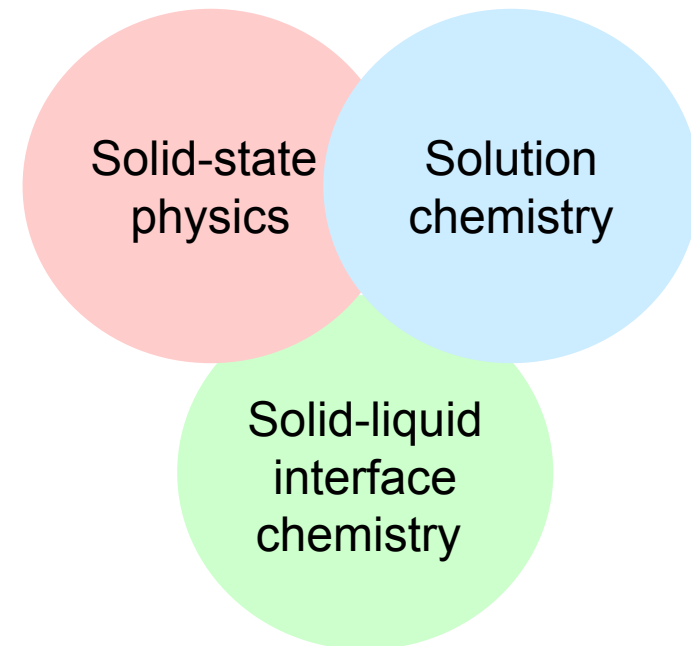
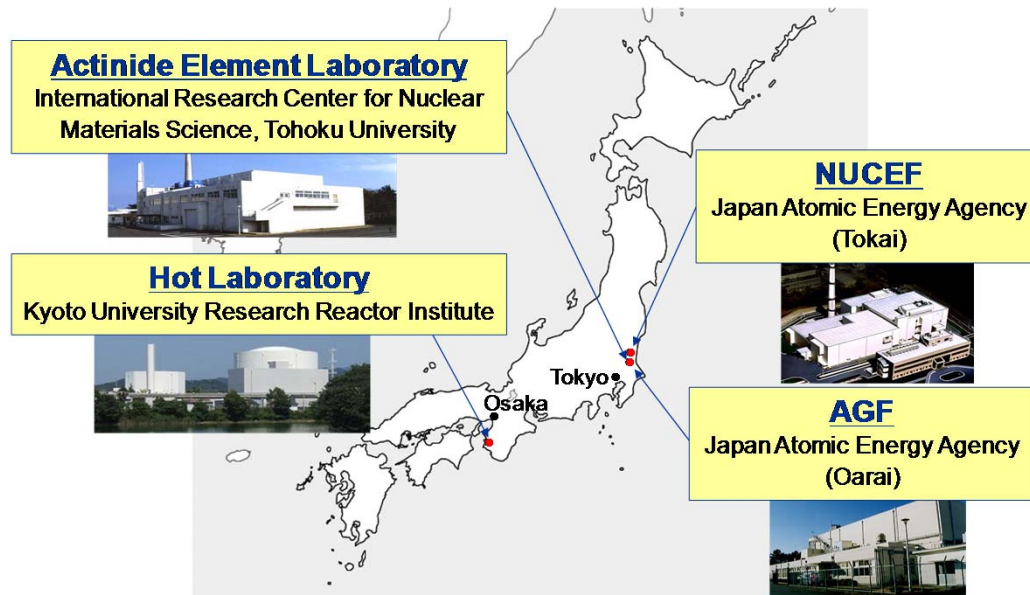
Funds from the Ministry of Education, Culture, Sports, Science and Technology of Japan; MEXT (Oct. 2008-March 2011)

- Training and education program: *ACTITRAIN*
 - » Organization of schools
 - J-ACTINET Summer School
 - J-ACTINET Computational Science School
 - » Overseas dispatch
 - International conferences
 - Summer schools in Europe

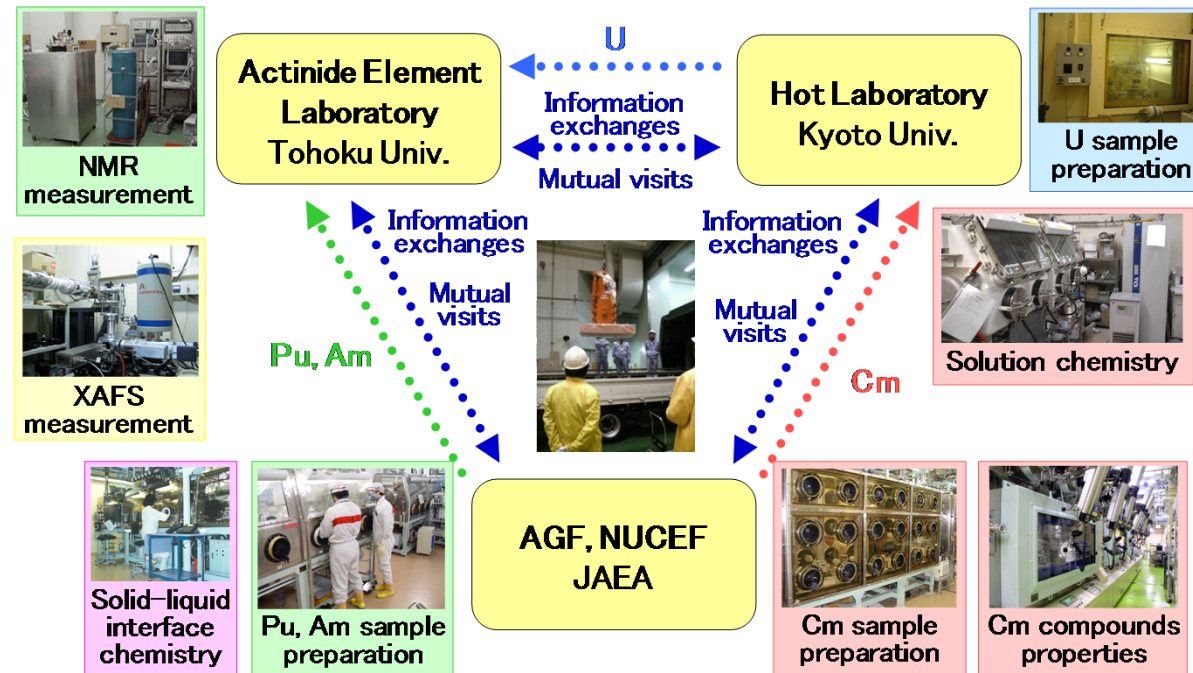


Funds from the Ministry of Education, Culture, Sports, Science and Technology of Japan; MEXT (Dec. 2010-March 2013)

- To make basic and fundamental actinide research **with young researchers** using four main facilities in Japan
 - » Young researchers from four universities and one institute
- Through this program the young researchers were expected
 - » **to learn how to make experiments** with advanced experimental tools
 - » **to broaden their horizons**



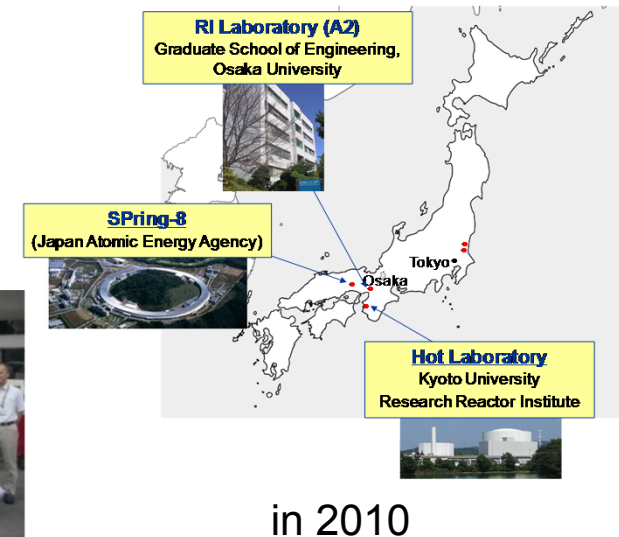
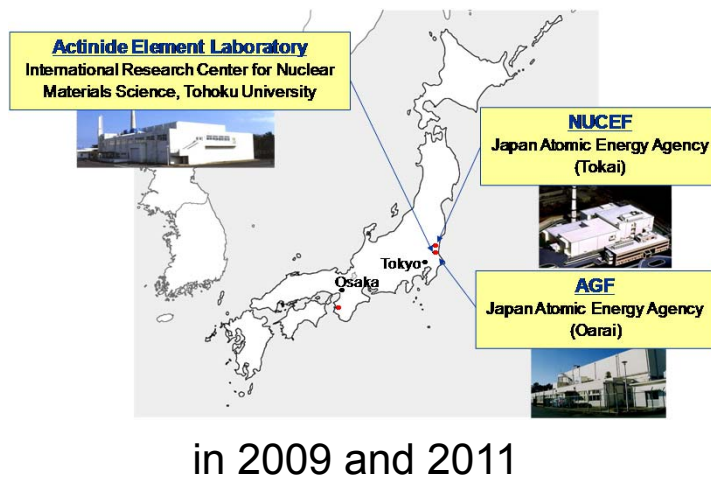
- The experiments were carried out in close cooperation with the facilities, including the supply of special actinide samples
 - » Information exchanges and mutual visits to facilities
 - » The experiments that could not be made in a single facility
 - » Various kinds of experiences to broaden horizons of young researchers



ACTITRAIN (1/7)

Summer School

- J-ACTINET Summer Schools 2009, 2010, and 2011
 - » 22 trainees (2 students, 14 graduate students, and 6 young researchers) in 2009
 - » 26 trainees (5 students, 18 graduate students, and 3 young researchers) in 2010
 - » 17 trainees (2 students, 9 graduate students, and 6 young researchers) in 2011
- To provide **students**, **graduate students**, and **young researchers** with chances to come into contact with actinide science research



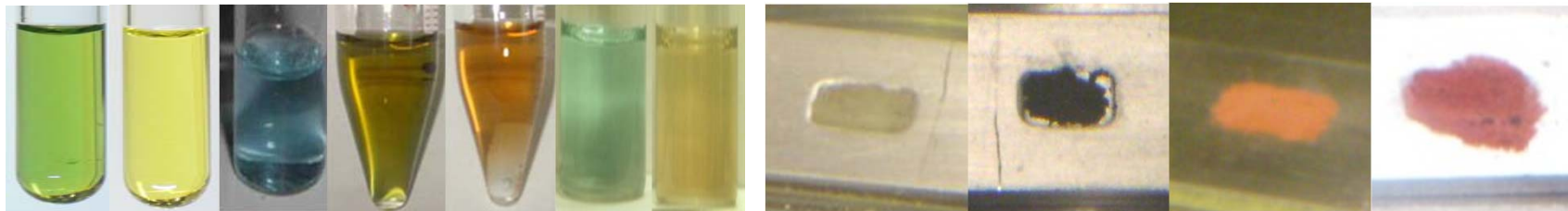
ACTITRAIN (2/7)

Summer School

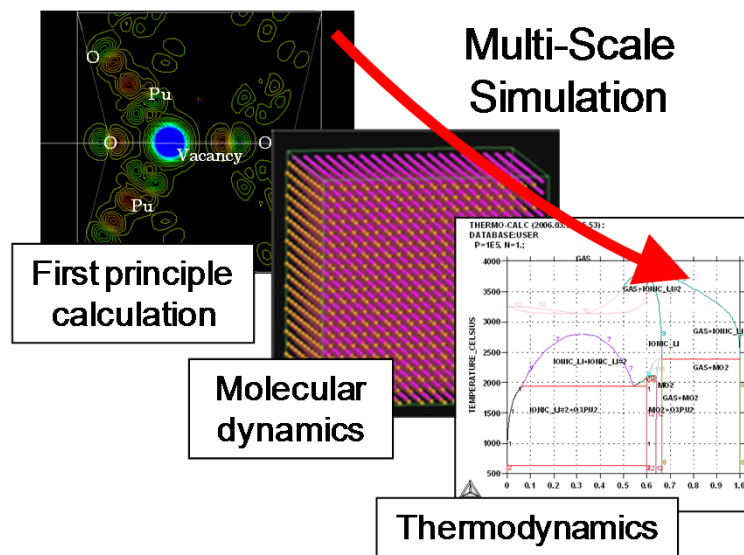
- Not only lectures on actinide science and its application, but also **practical exercises** on actinide chemistry and physics were made
 - » Practices of glove box and manipulator operations
 - » Observation of several kinds of actinide compounds and solutions
 - » Solvent extraction experiment of Am and Np
 - » Redox behavior observation of U in molten salt
 - » SEM/EPMA measurement of UO_2 and burnup simulated fuel
 - » Thermal diffusivity measurement of UO_2 and burnup simulated fuel
 - » γ -ray spectroscopy of irradiated fuels before and after heating
 - » Environmental radiation measurement/monitoring



- The **practical exercises** are very important and essential
 - » The trainees were impressed with the various colors of the actinide compounds and solutions
 - » They had a good experience of handling the actinide materials or surrogate materials
- The **technical visits** were made to research facilities
 - » AGF, NUCEF, J-PARC, FFAG Accelerator, Beam lines of SPring-8, XFEL facility and LWR fuel fabrication plant

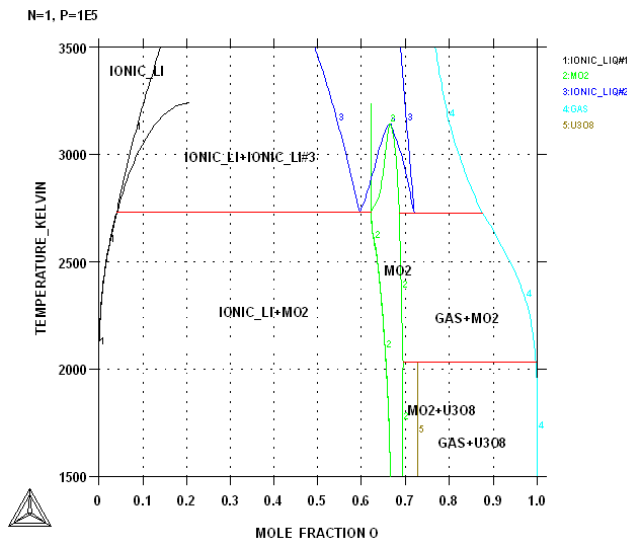
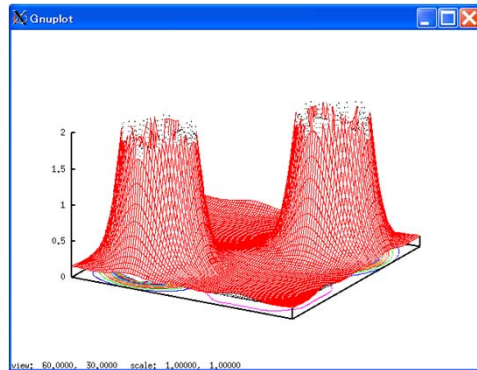


- J-ACTINET Computational Science School 2011
 - » 18 trainees (3 students, 9 graduate students, and 6 young researchers)
- To provide **students**, **graduate students**, and **young researchers** with chances to come into contact with computational science which can be applied to actinide science research



Modeling and simulation of nuclear fuels

- Not only lectures on computational science and its application, but also **practical exercises** on calculations were made
 - » Chemical thermodynamics calculation of actinide compounds
 - » First-principles calculation of actinide compounds



- **Technical visit** was made **to actinide research facilities** since even the computational scientists/analysts should be aware of experiments

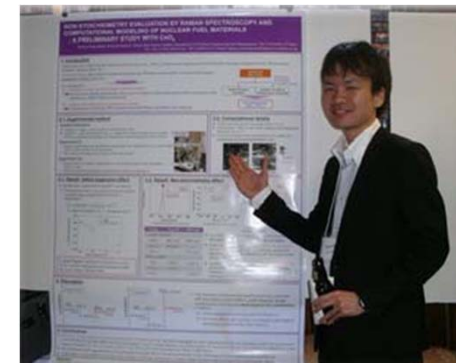
ACTITRAIN (6/7)

Overseas dispatch

- To provide **graduate students** and **young researchers** who are involved in actinide science research with **financial supports** for their participation in international summer schools and conferences
 - » Travel expenses
 - » Accommodation fee
 - » Registration/participation fee
- The participants are expected
 - » to develop communication ability
 - » to obtain the latest information
 - » to understand foreign culture
 - » to make foreign friends
 - » to broaden their horizons



- Summer schools in Europe
 - » 2 graduate students to **ACTINET-I3 Summer School 2011** in Karlsruhe, Germany
 - » 1 young researcher to **F-BRIDGE School 2011** in Cambridge, UK
- International conferences
 - » 1 graduate student to **UC Forum** held in Berkeley, USA
 - » 1 young researcher to **Molten Salts Chemistry and Technology (MS9)** in Trondheim, Norway
 - » 1 graduate student and 1 young researcher to **MIGRATION 2011** in Beijing, China
- Follow-up interviews are scheduled to be done





Summary and further challenges (1/2)

- J-ACTINET was established in 2008
 - » to promote and facilitate actinide science research in the close cooperation with the facilities
 - » to foster many young scientists and engineers to be actively engaged in the fields of actinide science through giving opportunities to come into contact with actinide science research
- The research program ACTILAB was carried out
 - » through which young researchers learned how to make experiments with advanced experimental tools and broadened their horizons
- The summer schools and computational science school were held
 - » to provide students, graduate students, and young researchers with the opportunities to come into contact with actinide science research and application of computational science to actinide science
 - » In these schools, not only the lectures, but also the practical exercises were made as essential part



Summary and further challenges (2/2)

- The overseas dispatch program was also carried out
 - » where graduate students and young researchers who are involved in actinide science research were sent to the international summer schools and conferences
- Aiming at further activation/progress in actinide science and training and education of students, graduate students and young researchers, **J-ACTINET would like to strengthen the network** through the cooperation with ACTINET in Europe and researchers in US and Asian countries

