Kyoto University
Research Reactor Institute

International Symposium on

Nuclear Back-end Issues and the Role of Nuclear Transmutation Technology after the accident of TEPCO's Fukushima Daiichi Nuclear Power Stations

28 November 2013
The Shiran Hall, Kyoto University

KURRI Research Program for Scientific Basis of Nuclear Safety

Programme
&
Abstracts

Preface

The nuclear accident at the TEPCO's Fukushima Daiichi NPP in March 2011, which followed an earthquake and a tsunami, brought serious impacts on society. This accident inevitably underlined the necessity of establishing new and comprehensive scientific research for promoting nuclear safety. Facing this situation, the Kyoto University Research Reactor Institute (KURRI) developed a new research program called the "KUR Research Program for Scientific Basis of Nuclear Safety" from 2012. In this program, it is planned to hold an annual series of international symposia along with identified research activities for promoting nuclear safety.

The second annual symposium in this series deals with nuclear back-end issues and the role of nuclear transmutation technology after the accident of the TEPCO's Fukushima Daiichi NPP, following the first one for the radiological effect of the accident on the public. As well as on the impacts of the accident, the accident has called us to focus our attention on a large amount of spent nuclear fuels stored in NPPs. In fact, public anxiety regarding the treatment and disposal of high-level radioactive wastes that require long-term control is now growing, while the government policy on the back-end of nuclear fuel cycle is unpredictable in the aftermath of the accident. The issues may not be simply technical, but are critically important not only for settling the accident but also for pursuing nuclear energy production in the world. It is thus needed to address the current status of the back-end issues and to discuss the future direction of research and development on radioactive waste treatment and disposal.

Approximately 9 invited lectures and 54 scientific papers will be presented in the symposium. Almost all the presentations have been written as original scientific papers, peer reviewed by specialists of the relevant research fields, and included in the proceedings booklet. On behalf of all the participants of the symposium, I sincerely hope that this symposium and its proceedings will contribute to the reduction of public anxiety and will promote further progress in the research on nuclear safety.

Hirotake Moriyama
Director, Kyoto University Research Reactor Institute
Chair of the organizing committee

Host Organization

Kyoto University Research Reactor Institute (KURRI)

Support organization

Atomic Energy Society of Japan

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Program

9:00-10:00 Registration, Poster Reception

10:00-10:15 **Opening Remarks** Prof. Hirotake Moriyama, Director of KURRI

10:15-10:45 **Decommissioning Activity at Fukushima Daiichi NPS**
Speaker : Mr. Hideki Masui (TEPCO)
Chair: Prof. Ken Nakajima (KURRI)

10:45-11:15 **Issue of the High-Level Radioactive Waste**
Speaker : Prof. Kenji Yamaji (RITE)
Chair: Prof. Ken Nakajima (KURRI)

11:15-11:45 **Roles of Nuclear Fuel Cycle Technologies on Geological Disposal**
Speaker : Prof. Joonhong Ahn (University of California, Berkeley)
Chair: Prof. Yoshiaki Kiyanagi (Nagoya University)

11:45-12:15 **Expectation to Nuclear Transmutation**
Speaker : Dr. Akito Arima (Musashi Academy)
Chair: Prof. Yoshiaki Kiyanagi (Nagoya University)

12:15-14:00 Lunch and poster session

14:00-14:30 **OECD / NEA Activities Related to the Nuclear Fuel Cycle**
Speaker : Dr. Thierry Dujardin (OECD)
Chair: Dr. Kazufumi Tsujimoto (JAEA)

14:30-15:00 **Contribution of the European Commission to a European Strategy for HLW Management through Partitionning & Transmutation**
- Presentation of MYRRHA and its in the European P&T strategy -
Speaker : Prof. Hamid Aït Abderrahim (SCK・CEN)
Chair: Prof. Hironobu Unesaki (KURRI)

15:00-15:30 **ADS Study in JAEA** Speaker : Dr. Hiroyuki Oigawa (JAEA)
Chair: Prof. Hironobu Unesaki (KURRI)

15:30-16:00 Coffee break and poster session

16:00-16:30 **Accelerator-Driven System (ADS) Study in Kyoto University Research Reactor Institute (KURRI)** Speaker : Prof. Cheol Ho Pyeon (KURRI)
Chair: Prof. Jun-ichi Katakura (Nagaoka University of Technology)

16:30-17:00 **Nuclear Data Study for Nuclear Transmutation**
Speaker : Prof. Masayuki Igashira (Tokyo Institute of Technology)
Chair: Prof. Jun-ichi Katakura (Nagaoka University of Technology)

17:00-18:00 **Panel Discussion** Chair: Prof. Ken Nakajima

18:00-18:15 **Closing Remarks** Prof. Hajimu Yamana

18:15-19:40 Reception

Poster sessions

Topics 1-a Nuclear transmutation - Reactor system –

1 Lu ZHANG, Kun FENG, Yucui GAO, Deliang FAN, Yongwei FANG
Physical Analysis of LBE Spallation Target for CIADS

2 Kun FENG, Lu ZHANG, Deliang FAN, Zhuang WU, Yongwei YANG
Analysis of Thermal-hydraulics for the LBE Spallation Target of ADS

3 Takanori KITADA, Vu Thanh MAI, Noboru DOBUCHI
Study on Neutron Spectrum of Pulsed Neutron Reactor

4 Toshihiro YAMAMOTO
Theory of power spectral density and Feynman-*a* method in Accelerator Driven System and their higher order mode effects

5 W.F.G. VAN ROOIJEN
Neutron requirement for transmutation of MA isotopes

6 Tetsushi HINO, Masaya OHTSUKA, Renzo TAKEDA, Junichi MIWA, Kumiaki MORIYA
Application of the Resource-renewable Boiling Water Reactor for TRU Management and Long-Term Energy Supply

7 Takanori SUGAWARA, Kenji NISHIHARA, Kazufumi TSUJIMOTO, Toshinobu SASA
Hironari OBAYASHI, Yuji KURATA, Hiroyuki OIGAWA
Investigations of Lead-Bismuth cooled Accelerator-Driven System

8 Toshinobu SASA, Hayanori TAKEI, Shigeru SAITO, Hironari OBAYASHI, Kenji NISHIHARA, Takanori SUGAWARA, Hiroki IWAMOTO, Kazufumi TSUJIMOTO, Hiroyuki OIGAWA
J-PARC Transmutation Experimental Facility

9 Kyoko ISHII, Mitsuaki YAMAOKA, Yasuyuki MORIKI, Takashi OOMORI, Yasushi TSUBOI, Kazuo ARIE, Masatoshi KAWASHIMA
Development of Uranium-Free TRU Metallic Fuel Fast Reactor Core with Enhanced Doppler Reactivity Feedback

10 Akihiro SASAHARA, Tetsuo MATSUMURA
Chemical Isotopic Analysis and Computational Evaluation of Nuclide Composition in PWR-UO_2 and MOX Spent Fuels Using JENDL, ENDF/B, JEF, and JEFF

11 Kenji KONASHI, Tsugio YOKOYAMA
Enhancement of Transmutation of Minor Actinides by Hydride Target

12 Hiroki SONO , Kotaro TONOIKE , Kazuhiko IZAWA , Takashi KIDA , Fuyumi KOBAYASHI , Masato SUMIYA , Hiroyuki FUKAYA , Miki UMEDA , Kazuhiko OGAWA, Yoshinori MIYOSHI
Project to Modify the STACY Critical Facility for Experimental Study on Fuel Debris Criticality Control

13 Naoto AIZAWA, Tomohiko Iwasaki, Tatsuro TAKANI, Takashi TANI, Shunsuke KANEMOCHI, Motomu SUZUKI, Fumito KUBO, Yasuaki WATANABE
ADS study in Tohoku University

14 Toshikazu TAKEDA, Koji FUJIMURA
Method Development for Calculating Minor Actinide Transmutation in a Fast Reactor

15 Daisuke ITO, Kazuki HASE, and Yasushi SAITO
Heat transfer study for ADS solid target
-surface wettability and its effect on a boiling heat transfer-

16 Gen ARIYOSHI, Daisuke ITO, and Yasushi SAITO
Experimental study of flow structure and turbulent characteristics in lead-bismuth two-phase flow

17 Kyoko Mukaida, Naoto Yasumatsu, Masanori Heta, Akira Ohtaki, Hiroki Shiotani, Kiyoshi Ono, Masaru Hirata
Scenario study for the transition from thermal reactors to fast reactors in the world

18 Tetsuya MOURI, Taira HAZAMA, Hiroshi NISHI
Current Status and Future Prospect of MA Irradiation Tests in Monju

19 Shigeo OHKI, Tsutomu OKUBO, Tomoyuki ABE
Study on Actinide Burning by Fast Reactor

20 Seung-Woo HONG, Sang-In BAK, Jong-Seo CHAI, J. P. Curbelo, Yacine KADI, Claudio TENREIRO
Neutronic analysis and transmutation performance of Th-based Molten Salt Fuels

Topics 1-b Nuclear transmutation - Fuel cycle –

1 Kenji NISHIHARA, Kazufumi TSUJIMOTO, Hiroyuki OIGAWA
Transmutation Scenarios after Closing Nuclear Power Plants

2 Kotaro TONOIKE, Hiroki SONO, Miki UMEDA, Yuichi YAMANE, Teruhiko KUGO, Kenya SUYAMA
Principle Options of Fuel Debris Criticality Control in Fukushima Daiichi Reactors

3 Seung-Woo HONG, Sang-In BAK, Masoud BEHZAD, Jong-Seo CHAI, Yacine KADI, Vijay K. MANCHANDA, Tae-Sun PARK, Claudio TENREIRO, Chirag K. VYAS
ADS Research Activities in Sungkyunkwan University

Topics 1-c Nuclear transmutation - Material science –

1 Shizuka TAKAI, Kouichi HAGINO
Nuclear transmutation of long-lived nuclides with laser Compton scattering : Quantitative analysis by theoretical approach

2 Kento YAMAMOTO, Keisuke OKUMURA, Kensuke KOJIMA, Tsutomu OKAMOTO
Sensitivity analyses of initial compositions and cross sections for activation products of in-core structure materials

3 Hiroaki MUTA, Toshiaki KAWANO, Yuji OHISHI, Ken KUROSAKI, Shinsuke YAMANAKA
Thermophysical properties of thorium oxide

4 Toshiaki KAWANO, Hiroaki MUTA, Yuji OHISHI, Ken KUROSAKI, Shinsuke YAMANAKA
Characterization and thermophysical properties of $RE_2Zr_2O_7$ and $Nd_2Ce_2O_7$ precipitate in ThO_2-based fuel

5 Minoru TAKAHASHI, Yun GAO, Marion GUIHOT, Asril PRAMUTADI
Overview of Studies on Lead-bismuth Technology in Tokyo Institute of Technology

6 Hironari OBAYASHI, Hayanori TAKEI, Hiroki IWAMOTO, Toshinobu SASA
Evaluation of structural integrity of beam window for TEF target by thermal/fluid-structure interaction analysis

7 K. HIROSE, T. OHTSUKI, Y. SHIBASAKI, N. IWASA, J. HORI, S. SEKIMOTO, K. TAKAMIYA, H. YASHIMA, K. NISHIO, and Y. KIYANAGI
Fission cross-section measurement of minor actinides using a lead slowing-down neutron spectrometer KULS at KUR

8 Tsuyoshi NISHI, Yasuo ARAI, Masahide TAKANO, Hirokazu HAYASHI, Masaki KURATA
Development of TRU nitride database for designing ADS fuel

9 M. KOIZUMI, F. KITATANI, H. TSUCHIYA, H. HARADA, J. TAKAMINE, M. KURETA, H. IIMURA, M. SEYA, B. BECKER, S. KOPECKY, W. MONDELAERS, P. SCHILLEBEECKX
Recent progress in research and development on the neutron resonance densitometry (NRD) for quantification of nuclear materials in particle-like debris

10 Marion GUIHOT, Minoru TAKAHASHI
Status of Studies and Future Subjects of Material Corrosion for Lead-bismuth Cooling System

11 Shigeru SAITO, Kenji KIKUCHI, Dai HAMAGUCHI, Shinya ENDO, Kouji USAMI, Naotoshi SAKURABA, Hiromitsu MIYAI, Katsutoshi ONO, Hiroki MATSUI, Masayoshi KAWAI, Yong DAI
Mechanical properties of beam window materials for ADS irradiated in a spallation environment

12 Jun-ichi HORI, Tadafumi SANO, Yoshiyuki TAKAHASHI, Hironobu UNESAKI, Ken NAKAJIMA
Development of non-destructive assay to fuel debris of Fukushima Daiichi NPP (1) Experimental validation for the application of a self-indication method

13 Tadafumi SANO, Jun-ichi HORI, Yoshiyuki TAKAHASHI, Hironobu UNESAKI, Ken NAKAJIMA
Development of non-destructive assay to fuel debris of Fukushima Daiichi NPP (2) Numerical validation for the application of a self-indication method

14 Shoji NAKAMURA
Precise Measurements of Neutron Capture Cross-Sections for LLFPs and MAs

15 Kenya SUYAMA, Gunzo UCHIYAMA, Hiroyuki FUKAYA, Miki UMEDA, Toru YAMAMOTO, Motomu SUZUKI
Development of the Method to Assay Hardly Measurable Elements in Spent Nuclear Fuel and Application to BWR 9×9 fuel

16 M. Yamawaki, T. Terai, T. Koyama, Y.Arita1, Y. Sekiguchi, K. Uozumi and M.Kinoshita
Evaluation of volatile FP elements behavior for severe accident analysis of molten salt reactor

Topics 2-a Back-end cycle issues - Radioactive waste treatment/disposal -

1 Nobuyoshi ISHII, Shinichi OGIYAMA, Shinji SAKURAI, Keiko TAGAMI, Shigeo UCHIDA
Environmental parameters for assessing the behavior of radiocarbon in the paddy soil-to-rice plant system

2 Jian ZHENG, Tagami KEIKO, Wenting BU, and Shigeo UCHIDA
Development of ICP-MS based analytical method for the determination of radioactive Cs isotopes

3 Asako SHIMADA, Mayumi Ozawa, Yutaka KAMEO, Takuyo YASUMATSU, Koji NEBASHI, Takuya NIIYAMA, Shuhei SEKI, Masatoshi KAJIO, Kuniaki TAKAHASHI
Development of rapid analytical method of ^{129}I in the contaminated water and woods arising at Fukushima Daiichi Nuclear Power Station

4 Shigeo UCHIDA, Keiko TAGAMI
Determination of low-level technetium-99 in the environmental samples by inductively coupled plasma mass spectrometry

5 Guosheng YANG, Jian ZHENG, Keiko TAGAMI, Shigeo UCHIDA
A simple and rapid method for separation and preconcentration of Ra in water samples

6 Hiromi TANABE, Kuniyoshi HOSHINO
Consideration on treatment and disposal of secondary wastes generated from treatment of contaminated water

7 Takayuki SASAKI, Akira KIRISHIMA, Yuu TAKENO, Kohei FUKUDA, Nobuaki SATO
A simulation of Sr leaching in aqueous solution mixed with seawater and preparation of U/Zr oxides at high temperatures

8 Yoko FUJIKAWA, Hiroaki OZAKI, Hiroshi TSUNO, Pengfei WEI, Aiichiro FUJINAGA, Ryouhei TAKANAMI, Shogo TANIGUCHI, Shojiro KIMURA
Volume reduction of municipal solid wastes contaminated with radioactive cesium by ferrocyanide coprecipitation technique

9 Takao TSUBOYA
A Prescription toward to the Long-term Isolation of High Level Radioactive Waste in Japan

10 Shinji YOSHIKAWA, Kouichi USHIRODA, Michiaki OHKUBO, Yutaka HISHIKI, Kiyoshi HOMMA
MEXT-Sponsored Research Activities for Environmental Load Reduction

11 Masahiko SAITO, Satoru SUZUKI, Isamu SETO
NUMO's activities after the Great East Japan earthquake

12 Akira KITAMURA, Yukio TACHI
Migration Parameters and their Evaluation and Estimation Methodologies of Safety-relevant Radionuclides for Performance Assessment of Japanese Geological Disposal of HLW and TRU Waste

13 Takamitsu ISHIDERA, Seiichi KUROSAWA, Masanori HAYASHI, Yasuyuki SUZUKI
Evaluation of Distribution Coefficients for Radionuclides Sorption on Bentonite Colloid

14 Yuya Takahashi, Hitoshi Nakamura, Akira Yamada, Koji Mizuguchi, Reiko Fujita
The treatment process of simulated debris from a severe accident using molten salt system

Topics 2-b Back-end cycle issues - Public acceptance -

1 Akemi YOSHIDA
Considering Geological Disposal Program of High-level Radioactive Waste through Classroom Debate