

About This Publication and the JAEA Organizational Outline

10

1

Research and Development Related to the Accident at TEPCO's Fukushima Daiichi NPS**Highlight**

Assistance in Environmental Restoration and Decommissioning

13

1-1**Revealing the Characteristics of Fuel Debris**– Formation Mechanisms of Metallic Fuel Debris Originating from Control Rods –
Takehiro Sumita

14

1-2**Development of Radiation Detector for Non-Destructive Assay of Nuclear Fuel Debris**– γ -ray Spectrometry System Specific to High Dose-Rate Measurements Using CeBr₃ –
Masaaki Kaburagi

15

1-3**Chemical Forms of Radionuclides in Fuel Debris**– Structure of Concrete Interaction Products and Distribution of Sr and Ba –
Ayako Sudo

16

1-4**To Establish Safer Criticality Management of Fuel Debris**– Optimization of the Core Configuration of the New STACY for Debris Simulation –
Satoshi Gunji

17

1-5**Methodology to Remove Cs from Soil**– Preparation for the Treatment of Contaminated Soil –
Xiangbiao Yin, Yoshikazu Koma

18

1-6**Toward Understanding Core Melting Behavior in RPVs**– Evaluation of RPV Failure Mechanism –
Hiroshi Madokoro

19

1-7**Laser Ultrasonic Approach to Detect Corrosion of Reinforced Concrete**– Toward Nondestructive Testing Technology for Decommissioning –
Akinori Furusawa

20

1-8**Aiming to Predict PCV Corrosion**– Development of Corrosion Database under Varying Irradiation Conditions –
Tomonori Sato

21

1-9**Radiation Position Detection under High Dose Rate Using Optical Fibers**– An Approach to Detect the Position of Radiation Focusing on the Wavelength Information of Light –
Yuta Terasaka

22

1-10**Impact of Large Typhoons on the Estuary Mass Flux**– Observation of Radioactive Cesium in the Estuary in 2019 –
Toshiharu Misonou

23

1-11**Visualization of Radiological Map Using Machine Learning**– Analytical Method Using Big Data of Radiation Measurements in Fukushima –
Miyuki Sasaki

24

1-12**Improving the Accuracy in Estimation of Air Dose Rate Decrease**– A New Model for Simulation of Temporal Changes Due to an Environmental Effect –
Masaki Andoh

25

1-13	Sediment Characteristics Determine the Behavior of Cesium in Rivers – Adsorption/Desorption Mechanism of Radioactive Cesium onto River Sediments – Kenso Fujiwara	26
1-14	Remobilization of Radiocesium from Sediments – Mass Balance of Dissolved ¹³⁷ Cs in an Artificial Reservoir in Fukushima – Hironori Funaki	27
1-15	Rapid Analysis of ⁹⁰Sr in Small Bone Samples – Applicability of Sr Resin for ICP-MS of ⁹⁰ Sr in Hard Tissues – Kazuma Koarai	28
1-16	Speciation of Cs in Tree Tissues – Elucidation of the Mobility of Cs inside Trees Using Synchrotron Radiation – Kazuya Tanaka	29
1-17	Where Does the Radiation Determining Air Dose Rates in Forests Originate? – Simulations Reveal the Connection between the Movement of Radioactive Cesium and Air Dose Rate Trends – Minsik Kim	30
1-18	Understanding the Cesium Adsorption Behavior in Concrete – Accurate Simulation of Cement Hydrate Using Machine Learning Molecular Dynamics – Keita Kobayashi	31

2 Research on Nuclear Safety and Emergency Preparedness

Highlight	Implementing Continuous Improvements in Safety and Emergency Preparedness	32
2-1	Reliable Thyroid Dose Measurement after a Severe Nuclear Accident – Developing a Portable Thyroid Dose Monitor – Sho Nishino	33
2-2	Can Contaminated Monitoring Posts Measure Accurately in a Nuclear Accident? – Influence of Contamination on Measured Dose Rates at Monitoring Posts – Hirokazu Hiraoka	34
2-3	Prediction of Structural Damage from Projectile Impacts – Numerical Evaluation of Penetration Damage under Realistic Conditions – Zuoyi Kang	35
2-4	Accident Simulation: HLLW Evaporation to Dryness – Evaluating the Restraint Effect on the Release of Volatile Ruthenium – Ryoichiro Yoshida	36
2-5	A Nonparametric Bayesian Method for Predicting the Embrittlement of Reactor Pressure Vessels – Toward Further Reliability of Integrity Assessment in Long-Term Operation – Hisashi Takamizawa	37
2-6	Migration of Radionuclides from Radioactive Wastes of Reactor Core Structures in Underground Environments – Modeling Niobium Sorption onto Clay Minerals in the Presence of Calcium – Saki Ohira	38

2-7

Detection of Undeclared Uranium Purification Activities– $^{230}\text{Th}/^{234}\text{U}$ Radio-Chronometry with a Single Uranium Particle –
Daisuke Suzuki

39

2-8

Operating Robots Entering the Accident Site on Behalf of a Person– Training of Robot Operators for Nuclear Disaster Response –
Yusuke Chiba

40

3

Advanced Scientific Research**Highlight**

Advanced Science Explores the Future

41

3-1

Nuclear Fission Unveiled via Multinucleon Transfer Reaction– Opening Fission Research in Unexplored Region of the Chart of Nuclei –
Katsuhisa Nishio

42

3-2

Determination of the Mass of a Ξ Hypernucleus– New Information to Understand the Structure of Neutron Stars –
Kiyoshi Tanida

43

3-3

Magnetic Cooling to Near Absolute Zero Temperatures– Cooling to Extremely Low Temperature Realized by Quantum Fluctuations in “Ytterbium Magnet” –
Yoshifumi Tokiwa

44

3-4

For a Radio-Resistant Thermoelectric Generation System– Tolerance of Spin Thermoelectric Devices for Radiation –
Satoru Okayasu

45

3-5

Elucidation of Low-Energy Vibrational Modes of Deuterated Water Clusters– Utilization of Terahertz-Infrared Absorption Spectroscopy and Ab Initio Calculation –
Koichiro Yamakawa

46

3-6

Exploration of the Exotic Structure of P_c – Hybrid State with a Mixture of Compact State and Hadron Molecule –
Yasuhiro Yamaguchi

47

4

Nuclear Science and Engineering Research**Highlight**

Fundamental Technologies for Nuclear Energy Innovation

48

4-1

Toward High-Energy Neutron Applications– Development of Nuclear Reaction Database for Basic Sciences and Medicine –
Shinsuke Nakayama

49

4-2	Estimating Nuclear Data Using a Machine Learning Technique – Toward the Development of a High-Quality Nuclear Reaction Database – Hiroki Iwamoto	50
4-3	Toward Clarifying the Chemical States of Nuclear Fuel Debris – Applicability of Micro-Raman Spectroscopy – Ryoji Kusaka	51
4-4	Reassessment of Atomic Bomb Survivor Doses – Joint Japan-U.S. Study to Improve Epidemiological Research Accuracy – Tatsuhiko Sato	52
4-5	Quicker calculation of Atmospheric Dispersion of Radioactive Materials under Various Conditions – Development of the Atmospheric Dispersion Database System WSPEEDI-DB – Hiroaki Terada	53
4-6	Clarification of the Spontaneous Microcracking of Aluminum Alloys – Toward the Realization of High-Strength Alloys through Computational Science – Tomohito Tsuru	54
4-7	Extent of Damage to Material when Exposed to Proton Beam – Contribution to the Safety of Accelerator-Driven Systems – Shin-ichiro Meigo	55

5

Neutron and Synchrotron Radiation Research

Highlight	Contributions to Innovative Achievement in Science and Technology	56
5-1	Toward Stable Operation of a High-Intensity Proton Beam – Development of an Online Monitoring System for the Injection Stripper Foil – Pranab Kumar Saha	57
5-2	Strengthening Mechanism of Cast Iron Elucidated by a High-Intensity Pulsed Neutron Beam – Deformation Response of Each Constituent Phase Monitored by Neutron Diffraction – Stefanus Harjo	58
5-3	Realization of a Highly Polarized Neutron Beam across a Wide Energy Range – Development and Application of a Neutron Polarization Device Using Highly Polarized ^3He – Takuya Okudaira	59
5-4	Strange Short-Range Order of Conduction Electron Spins Realized at High Temperatures – Unexpected State Found in the Newly Synthesized Magnet, Mn_3RhSi – Hiroki Yamauchi	60
5-5	Development of a Metal Adsorbent Using Bone Waste – A Low-Cost and High-Performance Metal Adsorbent Prepared from Food Waste – Yurina Sekine	61
5-6	Fast Molecules Passing through Carbon-Atom Net – Discovery of Oxygen Molecules Slipping through Graphene – Akitaka Yoshigoe	62

5-7

Atomic-Level Observation of Magnetic Ordering Process in Ferromagnetic Semiconductors
 – Exploring the Mechanism of Ferromagnetism for Its Practical Use in Spintronics Devices –
 Yukiharu Takeda

63

6

HTGR Hydrogen and Heat Application Research

Highlight

Research and Development on HTGR, Hydrogen Production, and Heat Application Technologies

64

6-1

Prediction of Thermal-Hydraulic Behavior in HTGR Accidents

– Development of Evaluation Methodology of Air-Ingress Behavior in HTGR –
 Takeshi Aoki

65

6-2

Nuclear Design Policy to Maintain the Integrity of Coated Fuel Particles

– Derivation of the Ideal Power Distribution to Minimize the Kernel Migration Rate –
 Shoichiro Okita

66

6-3

Toward the Realization of High Temperature Gas-Cooled Reactor for Safe Reduction of Plutonium Inventory

– Microstructure Observation of a Simulated Fuel Kernel –
 Jun Aihara

67

6-4

Toward Metallic Sulfuric Acid Decomposers in the IS Process

– Discovery of Steel Materials with Corrosion Resistance Equivalent to Ceramics in a Sulfated Gas Environment –
 Noriaki Hirota

68

6-5

Membrane Technique Advancing the IS Process

– Enhancement of the HI Conversion by Silica-Based Membrane Reactor –
 Odtsetseg Myagmarjav

69

6-6

Energy Saving of the Main Reaction in the IS Process

– Membrane and Electrode Development for the Bunsen Reaction Overvoltage Reduction –
 Nobuyuki Tanaka

70

6-7

Shortening the Calculation Working Time for the Criticality Control Rod Position

– Development of a Utility Tool for Auto Seeking the Critical Control Rod Position –
 Hai Quan Ho

71

7

Research and Development of Fast Reactors

Highlight

Development of Technology Base and Infrastructure toward Improving the Fast Reactor Cycle

72

7-1

Observation of Nuclides Adsorbed inside the Column Using Neutrons

– Non-Destructive Visualization of Nuclides by Resonance Neutron Imaging –
 Yasunori Miyazaki

73

7-2	Improvement of the Calculation Accuracy of Power Distribution for Large Fast Reactors – Refinement of Control-Rod Calculation Method – Kazuo Takino	74
7-3	Clarification of the Relocation Behavior of Degraded Fast Reactor Core Materials under Severe Accident – Development of Thermophysical Properties Database for Stainless Steel Containing Boron Carbide – Toshihide Takai	75
7-4	Optimization of Alloying Components of Nuclear Core Materials – Development of an Estimation Method for Irradiation-Induced Point Defect Behavior – Yoshihiro Sekio	76
7-5	Improvement and Demonstration of an Extraction Chromatography Flow-Sheet to Recover Trivalent Minor Actinides – Efficient MA(III)/Ln(III) Separation Process – Sou Watanabe	77

8 Research and Development on Fuel Reprocessing, Decommissioning, and Radioactive Waste Management

Highlight	Toward Decommissioning Nuclear Facilities and Managing Radioactive Waste	78
------------------	---	----

8-1	Implementation of Disposal Project of LLW Generated in Research, Medical, and Industrial Facilities – Preparation of “Concentration Equivalent Dose Criteria” as the Standard for the Selection of Important Nuclides – Toshikatsu Sugaya	80
8-2	Recovery of Nuclear Materials from Spent Extraction Solvent Using Solid Adsorbent – Investigation of Complex Formation Reaction of Iminodiacetic Acid Group in Solvent – Yoichi Arai	81
8-3	Turning Difficult-to-Treat Wastes into Stable Waste Packages – Investigation of Radioactive Aluminum Waste Treatment Technology Using the Bayer Process – Misaki Seki	82
8-4	Safety Improvements for Plutonium-Handling Facilities – Development of Fireproof Sheet on Glove Box Panels – Kohei Kawasaki	83
8-5	Direct Observation of the Fracture Induced by Gallery Excavation – Visualization Technology Using a Resin Injection Method – Akitaka Sakurai	84
8-6	Factors Affecting Rock Desaturation in Tunnel Excavation – Numerical Simulation on the Effects of Dissolved Gas and Rock Permeability – Kazuya Miyakawa	85
8-7	From Micro to Macro: Approaching Mountain Formation Processes Based on Age Determinations of Minerals – Insights to the Ou Backbone Range Obtained from Low-Temperature Thermochronology – Shoma Fukuda, Shigeru Sueoka	86
8-8	Reduced Geological Sample Size for Radiocarbon Dating at JAEA-AMS-TONO – Preparation Techniques Using One-Twentieth the Sample Size of the Conventional Method – Takahiro Watanabe	87

8-9	Safety Assessment Considering the Evolution of Topography and the Depth of the Disposal Facility – Development of an Analysis Tool to Evaluate the Topography and Depth of a Disposal Facility – Masaaki Yamaguchi	88
8-10	Electrochemical Methods to Evaluate Overpack Corrosion – Search for Passivation Conditions of Carbon Steel Surrounded by Buffer Material – Ayami Kitayama	89

9

Computational Science and E-Systems Research

Highlight	Computational Science for Nuclear Research and Development	90
9-1	Plume Dispersion Simulations Satisfying Accuracy Criteria for Environmental Assessments – Real-time Ensemble Calculations with Meter-Order Resolution – Naoyuki Onodera	91
9-2	Exascale CFD Simulations on Fugaku and Summit – Development of Mixed-Precision Matrix Solvers for Many-Core CPUs and GPUs – Yasuhiro Idomura	92
9-3	Theoretical Prediction of “Fermi Arc” – Development of Novel Method for Analyzing Strongly Correlated Electrons in Heavy-Element Compounds – Yuki Nagai	93
9-4	Prevention of Hydrogen Embrittlement in Aluminum Alloys – Identification of the Intermetallic Compounds that Take Away Hydrogen from Aluminum Lattice – Masatake Yamaguchi	94

10

Development of Science & Technology for Nuclear Nonproliferation

Highlight	Development of Technology and Human Capacity Building in the Nuclear Nonproliferation and Nuclear Security Fields to Support the Peaceful Use of Nuclear Energy	95
10-1	Toward a World without Nuclear Weapons and Nuclear Terrorism – Case Study and Factor Analysis of Denuclearization – Makiko Tazaki	96