

About This Publication and the JAEA Organizational Outline	10
--	----

1

HTGR Hydrogen and Heat Application Research

Highlight	Research and Development on HTGR, Hydrogen Production, and Heat Application Technologies	13
1-1	Development of a Neutron Detector with Improved Heat Resistance – Consideration of the Thermal Cycle Load Specific to High Temperature Gas-Cooled Reactors – Takayuki Kozawa	14
1-2	Toward the Demonstration of H₂ Production Technology Using the HTGR – Development of Safety Design Philosophy for HTTR Heat Application Test Facility – Takeshi Aoki	15
1-3	Evaluation of the Fuel Integrity of High Temperature Gas-Cooled Reactor to Maximize the Performance – Improvement of the Failure Assessment Method of Tristructural Isotropic Fuel Performance for High Temperature Gas-Cooled Reactor – Shoichiro Okita	16
1-4	Feasibility Study on Reprocessing Technology of HTGR Spent Fuel – Improving the Economics of Reprocessing Based on the Existing PUREX Technology – Yuji Fukaya	17
1-5	Toward Stable Hydrogen Production by the IS Process – Development of a Composition Control Method to Prevent Pipe Clogging by Iodine Precipitation – Yu Kamiji	18
1-6	Energy Saving for H₂ Production by the IS Process – Membrane Development for HI Concentration to Suppress Swelling by Cross-Linking – Nobuyuki Tanaka	19
1-7	Enhancement of Corrosion Resistance of the Metallic Components Used in the IS Process – Exploring a Coating Material That Can Withstand a Sulfuric Acid Boiling Environment – Noriaki Hirota	20

2

Research and Development of Fast Reactors

Highlight	Development of the Technology Base and R&D Infrastructure for Fast-Reactor Cycles	21
2-1	Measures Against Beyond Design-Basis Accidents to Effectively Reduce Accidents Possibly Involving Core Damage – Probabilistic Risk Assessment Results for Fast Reactor Operational Conditions – Hiroyuki Nishino	22
2-2	In-Vessel Retention of Molten Core Materials – Visualization Experiment of Molten Core Materials Penetrating into Liquid Sodium – Kenichi Matsuba	23
2-3	Prediction of Whole-Plant Thermal-Hydraulic Performance in Sodium-Cooled Fast Reactors – Coupling of One-Dimensional Plant Dynamics Analysis and Three-Dimensional Detailed Analysis Codes – Kazuo Yoshimura	24

2-4	Feasibility Study of Application of Dissimilar Welding Technology to Fast-Reactor Wrapper Tubes – Applicability to Fast-Reactor Core Revealed by Microstructural Analysis – Takashi Tanno	25
2-5	Toward an Efficient Shielding Design of Fast Reactors – Evaluation of Sodium Radioactivity in the Primary System of the Prototype Fast Reactor Monju – Tetsuya Mouri	26

3
 Advanced Scientific Research

Highlight	Fundamental Sciences to Realize New Era of Nuclear Science and Technology	27
3-1	Establishment of a γ-Ray-Spectroscopy Technique to Study Actinide Nuclei – Advancing Research on the Nuclear Structure of Superheavy Elements – Riccardo Orlandi	28
3-2	Uncovering the Origin of Short-Range Repulsive Nuclear Force Produced by Quarks – Σ^*p Scattering Experiment at J-PARC – Takuya Nanamura	29
3-3	Successful Growth of High-Quality Uranium-Based Superconducting Crystals – Contributing to the Elucidation of the Mechanism of Uranium-Based Superconductivity – Hironori Sakai	30
3-4	Toward Highly Sensitive Detection of Sound Waves – Sound Waves Drastically Alter Current–Voltage Characteristics – Michiyasu Mori	31
3-5	Why Can One Atomic Layer Graphene Separate Hydrogen and Deuterium? – Toward the Mass Production of Deuterium Based on Quantum Tunneling – Satoshi Yasuda	32
3-6	Development of a New, Multilayered Electrode for Tunnel Magnetoresistance Devices with High-Performance and Functionality – New Tunnel Magnetoresistance Devices for Advanced Industrial Applications – Kazuya Suzuki	33
3-7	Mysterious Energy Hidden in Thin Magnets – Theory of Energy Generation in Extremely Small Systems – Kei Suzuki	34

4
 Nuclear Science and Engineering Research

Highlight	Fundamental Technologies for Nuclear Energy Innovation	35
4-1	Development of a Nondestructive Analysis System for Nuclear Material Measurement by Active Methods – World’s First System Capable of Conducting Three Nondestructive Measurements – Harufumi Tsuchiya	36

4-2	Foundational Database for Diversifying Needs – Development of the Latest Nuclear Data Library JENDL-5 – Osamu Iwamoto	37
4-3	Toward High Recovery Yields of Pyrochemical Reprocessing for Minor Actinide Transmutation Nitride Fuels – Chlorination of Neptunium in Platinum Group Elements Compounds Without Using Corrosive Gases – Hirokazu Hayashi	38
4-4	Development of a New Corrosion Inhibition Method Using Chelation Technique – Crevice Corrosion Suppression by EDTA-Based Metal-Ion Introduction – Takahito Aoyama	39
4-5	Computational Design of High-Strength Alloys – Element Strategy Alloy-Design via Electronic Structure Calculations – Tomohito Tsuru	40
4-6	Mechanism of Actinide Transfer Between Water and Oil – Studies of the Molecular Structure of Solvent Extraction Interfaces Using Vibrational Sum Frequency Generation Spectroscopy – Ryoji Kusaka	41
4-7	Development of a System for Whole-Body Dose Assessment in Carbon Ion Radiotherapy – Use of Past Experience in Carbon Ion Radiotherapy to the Future of Radiotherapy – Takuya Furuta	42
4-8	Measuring Neutrons Emitted in Spallation Reactions – Toward Improving Prediction Accuracy Using Nuclear Reaction Models – Hiroki Iwamoto	43

5
 Neutron and Synchrotron Radiation Research

Highlight	Contributions to Innovative Achievement in Science and Technology	44
5-1	Beam Loss Assessment of High-Intensity Negative Hydrogen Ion Beams – Observation of Neutral Beams Generated by Residual Gas Electron Stripping – Jun Tamura	45
5-2	Inelastic Neutron Scattering Experiments Under the Highest Pressure in the World – Observation of Hydrogen Vibrational Excitation of Metal Hydrides at 21 GPa – Takanori Hattori	46
5-3	Neutron Diffraction Experiments Under Pulsed High Magnetic Fields – Development of a High-Field Pulsed Magnet System Exceeding 30 T – Masao Watanabe	47
5-4	Neutron Scattering Measurements for Magnetic Moment in Comparison with Nuclear Spin Polarization – A New Technique Useful in Study on Magnetism and Material – Naoto Metoki	48
5-5	Visualizing Lithium-Ion Transfer in All-Solid-State Batteries – Neutron Depth Profiling for the Operand Measurement of Li Ions – Takahito Osawa	49
5-6	Demonstration of Laser-Assisted Separation of Actinides – Enhancing Selectivity in Solvent Extraction by Manipulating f-Electrons with Light – Keiichi Yokoyama	50

5-7

Growth Process of Silicon Oxide Films Revealed Using High-Brightness Synchrotron Radiation
– Interfacial Defects and Carrier Trapping Dominate the World of Nanodevices –
Yasutaka Tsuda

51

6 Computational Science and E-Systems Research

Highlight Computational Science for Nuclear Research and Development 52

6-1

Can Machine Learning Predict the Atomic Motion Inside Nuclear Fuel Materials?
– Toward the Application of Machine-Learning Molecular Dynamics to Nuclear Fuel Materials –
Keita Kobayashi

53

6-2

Specificity of Liquid Metal Embrittlement
– Energy Criteria for Embrittlement: Atomistic Weak Interactions –
Masatake Yamaguchi

54

6-3

Understanding Hydrated Radium at the Molecular Level
– The Advent of Molecular-Level Research on Radium 125 Years After the Discovery of the Element –
Akiko Yamaguchi

55

6-4

Exploring Large-Scale Simulations in Virtual Space
– Making Interactive Remote Virtual Reality Visualization Possible –
Takuma Kawamura

56

6-5

New Data Conversion Method to Accelerate Nuclear Simulation
– Matrix Solvers with 16-Bit Operations Achieve Same Convergence as 64-Bit Operations –
Takuya Ina

57

7 Development of Science & Technology for Nuclear Nonproliferation

Highlight Development of Technology and Human Capacity Building in the Fields of Nuclear Nonproliferation and Nuclear Security to Support the Peaceful Use of Nuclear Energy 58

7-1

Prevention of Acts of Nuclear/Radiation Terrorism at Large Public Events
– Development of Detection Equipment to Estimate the Direction of Incoming Neutrons –
Takahashi Tohn

59

8

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

Highlight ● R&D for decommissioning the FDNPS / ● R&D for environmental restoration 60

8-1

Lessons Learned from the Chornobyl Nuclear Power Plant
– What is the Condition Needed to Suppress Degradation of Fuel Debris? –
Toru Kitagaki

● 62

8-2

Radiation Emitted from Fuel Debris
– Elucidation of the Characteristics of Bremsstrahlung X-Rays and Effects of the Dose Rate –
Taichi Matsumura

● 63

8-3

Utilizing the Directivity of Cherenkov Radiation to Distinguish ⁹⁰Sr/⁹⁰Y and ¹³⁷Cs
– Simultaneous Detection of the Source Positions of ⁹⁰Sr/⁹⁰Y and ¹³⁷Cs –
Yuta Terasaka

● 64

8-4

Automatic Discrimination of Structure Category in the Workspace
– Development of a Structure Discrimination Method by Deep Learning Based on 3D Point Cloud –
Takashi Imabuchi

● 65

8-5

Toward Predicting Cesium Distribution in FDNPS
– Improvement of the Analysis Code of Cesium Behavior in a Severe Accident –
Shuhei Miwa

● 66

8-6

Toward Predicting the Properties of Cesium Remaining in FDNPS Reactor Buildings
– Clarification of Cesium Adsorption on Nonferrous Structural Materials –
Kunihisa Nakajima

● 67

8-7

Toward the Safe Storage and Management of Wastes Such as Fuel Debris
– Research and Development on Hydrogen Leakage/Diffusion Behavior Analysis –
Atsuhiko Terada

● 68

8-8

Numerical Analysis of Hydrogen Combustion Behavior
– Effects of Temperature and Pressure on Flame Instability –
Thwe Thwe Aung

● 69

8-9

Estimating Fuel Debris Temperature in FDNPS Unit 2 Under Air-Cooling Condition
– Numerical Simulation of Fuel Debris Heat Transfer –
Susumu Yamashita

● 70

8-10

Effects of Forests on ¹³⁷Cs Behavior in River Catchment
– Development of a Watershed Model Combined with ¹³⁷Cs Migration in a Forest –
Kazuyuki Sakuma

● 71

8-11

Future Behavior of Radiocesium on Land
– Prediction of Radiocesium Behavior on Land for 30 Years –
Tsubasa Ikenoue

● 72

8-12

Remobilization Mechanism of Radiocesium from Bottom Sediments in Reservoir
– Vertical Distribution of ¹³⁷Cs in Sediment-Pore Water –
Hironori Funaki

● 73

8-13

Observation of Radiocesium Behavior in Estuaries
– Estimating the Origin of Particles Forming Turbid Layers near the Seabed –
Toshiharu Misonou

● 74

8-14

Lichen as a Recorder of Radiocaesium
– Determining Radiocaesium Distributions in Biological Tissues by Combining Analytical Equipment –
Terumi Dohi

● 75

8-15	Toward the Rapid Analysis of Plutonium Isotopes – Analytical Technique Without Pretreatments – Makoto Matsueda	● 76
8-16	Reviews on Exposure Management for Residents After the Accident in Fukushima – Toward the Lifting of Evacuation Orders for the Benefit of the Residents – Kazuya Yoshimura	● 77

9 Research and Development on Geological Disposal Technology

Highlight	R&D to Improve the Reliability of Geological Disposal Technologies in Japan	78
------------------	--	----

9-1	Direct Observation of Fractures to Estimate Future Permeability – Application of Fracture Visualization Technology by Resin Injection – Kazuhei Aoyagi	79
9-2	Deep Groundwater Physicochemical Components Affecting Actinide Migration – Addition of Trace Elements to Groundwater in Granite and Mudstone – Kazuya Miyakawa	80
9-3	Estimating the Erosion History Around the Depth of Geological Disposal – Reconstructing Thermal History by Optically Stimulated Luminescence Thermochronometry of Borehole Cores – Manabu Ogata	81
9-4	Accelerator Mass Spectrometer: The Challenge of Ultra-Downsizing – Filtering Atoms and Molecules Using Crystal Surfaces – Satoshi Jinno	82
9-5	Bentonite Swelling and Interlayer Cation Behavior – Why the Expandability of Montmorillonite is Different Between K^+ and NH_4^+ in Bentonite? – Ryohei Kawakita	83
9-6	Evaluation of Radionuclide Migration by a Diffusion Model – Diffusion Test and Model Development for Compacted Ca-Bentonite – Yuta Fukatsu	84

10 Steadily Promote Backend Measures with the Highest Priority on Safety

Highlight	Decommissioning of Nuclear Facilities and Disposal of Radioactive Waste	85
------------------	--	----

10-1	Toward an Efficient Design for Disposal Facilities – Evaluation of Skyshine Dose Generated from Disposal Facilities – Mizuki Nakamura	86
10-2	Toward the Practical Application of Flame-Retardant Waste Treatment Test Equipment – Selection of Repair Materials for the Main Reactor Refractory – Jun Kijima	87

10-3	Toward Using Geopolymer for the Treatment of Radioactive Wastes – Investigation on the Possible Pathway of Zeolites Formation in the Geopolymer – Junya Sato	88
10-4	Toward the Safe and Long-Term Storage of Plutonium – Aggregation of Plutonium and Shift to PVC-Free Storage – Shun Hirooka	89

11 Research on Nuclear Safety and Emergency Preparedness

Highlight	Implementing Continuous Improvements in Safety and Emergency Preparedness	90
------------------	--	----

11-1	Toward Rapid Inspection for Evacuation Vehicle Contamination in a Nuclear Emergency – Examination of the Performance of the Portal Monitor to Inspect Vehicles of Evacuees – Hirokazu Hiraoka	91
11-2	Clarifying Damage Conditions of Structures Subjected to Projectile Impact – Investigation of Damage Condition of Reinforced Concrete Panels Simulating Outer Walls of a Nuclear Building – Yukihiko Okuda	92
11-3	Toward Improving the Accuracy of the Structural Integrity Assessment Method for Reactor Pressure Vessels – Effect of Stainless-Steel Overlay Cladding on Fracture Behavior of the Reactor Pressure Vessel – Masaki Shimodaira	93
11-4	Toward More Rational Light Water Reactor Fuel Design and Safety Assessment – Establishing a Model to Predict Irradiation Growth in Zirconium-Based Alloy Claddings – Kazuo Kakiuchi	94
11-5	Confinement of Radioactive Materials Within the Facility Under Fire Conditions – Evaluation of the Properties of High-Efficiency Particulate Air Filters Clogged with Soot from Burned Gloveboxes – Shinsuke Tashiro	95
11-6	Accurate Estimation of the Three-Dimensional Distribution of Groundwater Contamination – Expectation for Contribution to Understand Underground Contamination for Decommissioning – Shizuka Takai	96
11-7	Filtering Out Radioactive Materials from a Pool During Severe Accidents – Evaluation of Two-Phase Flow Behavior During Pool Scrubbing by Computational Fluid Dynamics Simulation – Yuria Okagaki	97
11-8	Validation of the Latest Nuclear Data Library – Postirradiation Experiment Analysis of Pressurized Water Reactor Fuels Using JENDL-5 – Tomoaki Watanabe	98