

Contents

1. Space, Nuclear and Energy Engineering	1
1-01 Radiation Tolerance of New Coverglass for Space Solar Sheet	5
1-02 Proton Induced Degradation of Triple Junction Amorphous Silicon Thin Film Solar Cells	6
1-03 Applicability of the Improved Radiation Hardness Techniques for Angle Irradiation in DICE Latches on a 65 nm Bulk CMOS Process	7
1-04 Influence of Generated Charge by High Energy Ion Irradiation on Soft Error Rate in SOI SRAM	8
1-05 Radiation Damage in $\text{Si}_{1-x}\text{Ge}_x$ Source/Drain p-type MOSFETs	9
1-06 Anomalous Charge Collection from 4H-SiC Schottky Barrier Diodes	10
1-07 Atomic and Electronic Structure Analysis of the Interface between α - SiO_2 and 4H-SiC(11-20)	11
1-08 Proton Irradiation Effects on Nitride Semiconductor-based Light Emitting Device	12
1-09 Evaluation of Radiation Tolerance of FRAM Microprocessor for Heavy Ion Irradiation	13
1-10 Experimental Study on Radiation Effects on Magnetic Tunnel Junctions 2	14
1-11 Ion Beam Induced Luminescence (IBIL) from Diamond Induced by Various Single Ion with High Energy	15
1-12 Fabrication of Strongly Coupled Pair of NV Centers in Diamond by Ion Implantation	16
1-13 Radiolytic Stabilities of Hydrophilic and Lipophilic Ligands for Mutual Separation of Am/Cm/Ln	17
1-14 Characterization of Composite Adsorbent for Minor Actinides by Micro-PIXE Method	18
1-15 Radiolytic Stability of Metal Hexacyanoferrate as Adsorbent for Recovery of Cesium Ion	19
1-16 Study on Durability of Strontium Adsorbents against Gamma Irradiation	20
1-17 Effect of Gamma-ray Irradiation on De-oxygenation of Salt-containing Water by Hydrazine	21
1-18 Evaluation of Hydrogen Gas Generation from Cement Solidification Form by Gamma-ray Irradiation II	22
1-19 Studies of Irradiation Effects on Surface Structure of Zeolites after Decontamination of Radioactive Water	23
1-20 Evaluation of Radiation Resistance of Activated Sludge Used for Nitrate Ion Decomposition	24
1-21 Radiation Resistance Test of Insulation for Instrumentation Wire of JT-60SA Magnet	25

1-22	Radiation Resistant Evaluation of Sealing Coat Using Super Quick Hardening Type Polyurethane and Polyurea	26
1-23	Study of Radiation Resistance of Optical Fibers for Remote Imaging and Spectroscopy	27
1-24	Study of Radiation-resistant LED Lighting	28
1-25	Creation of Database of Radiation Resistance on Polymer Materials and Equipment	29
1-26	Evaluation of High-temperature Irradiation Resistance of ODS Ferritic Steel for Fast Reactor Application	30
1-27	Irradiation Hardening Behavior of SUS316L and F82H Steels in Heavy Irradiation Fields up to 250 dpa	31
1-28	Radiation-induced Hardening for SUS316L with Bending Deformation	32
1-29	Irradiation Hardening of Extra High Purity Ni-base Superalloy under External Stress	33
1-30	Irradiation Hardening of G-Phase Strengthened Ni-base Alloy under Multi-ion Irradiation	34
1-31	Precipitate Stability and Swelling Resistance of High-Nickel Alloy during Irradiation	35
1-32	Effects of Displacement Damage and Gas Atoms on Radiation Hardening and Microstructure in F82H Weldment	36
1-33	Corrosion Tests of Steels Used for Reactor Pressure Vessel and Primary Containment Vessel	37
1-34	Corrosion Resistance of Tank Material Used for Flock Storage	38
1-35	Investigation of Microstructure in SiC Made by Nano-infiltration Transient Eutectic Process after Triple Ion Beam Bombardment	39
1-36	Ionizing Dose Dependences of Radiation-induced Conductivity and Radiation-induced Electrical Degradation of Chemical Vapor Deposited Silicon Carbides under Gamma-ray Irradiation	40
1-37	Surface Morphology of He Implanted CeO ₂ Thin Film	41
1-38	A Macroporous SiC Material Synthesized from Pre-ceramic Polymer with Direct Foaming and Radiation Curing	42
1-39	Alkaline Durable Anion Exchange Membranes Synthesized by Radiation-induced Grafting for Hydrazine Hydrate Fuel Cell	43
1-40	Preparation of Anion-Exchange Membranes for Fuel Cell Applications by γ -ray Pre-irradiation Grafting: Effect of the Carbon Dioxide in the Air	44
1-41	Poly(ether ether ketone) (PEEK)-based Graft Type Polymer Electrolyte Membrane: Relative Humidity Dependence for Fuel Cell Application	45
1-42	Preparation of Novel Polymer Electrolyte Membranes by Combination of Radiation Induced Grafting and Atom Transfer Radical Polymerization	46
1-43	Preparation of Platinum Nanoparticle Catalysts for Fuel Cell Applications by Ion Implantation	47

1-44	Ion Content of Ion Exchange Membrane in HI-I ₂ -H ₂ O Mixture	48
1-45	Applied-voltage Dependence on Conductometric Track Etching of Poly(vinylidene fluoride)	49
1-46	Microscopic Evaluation of the Absolute Fluence Distribution of an Ion Beam Using a Track Etching	50
2.	Environmental Conservation and Resource Exploitation	51
2-01	Homogeneous Transesterification Kinetics of Triglyceride to Biodiesel Using Grafted Fibrous Catalyst	53
2-02	Effect of Initial Radical Concentration on Radiation-induced Graft Polymerization on Polyethylene Nonwoven Fabric	54
2-03	Development of the Water Purifier with Grafted Adsorbent for Cs Removal	55
2-04	Development of a Grafted Filter for Radioactive Cesium	56
2-05	The Influence on the Vulcanized Rubber Physical Properties by Radiation Grafting	57
2-06	Radiation-induced Crosslinking of Poly(butylene adipate-co-terephthalate)	58
2-07	Effect of Gamma-rays Irradiation on Concentrated Aqueous Solutions of BSA, DNA and Their Mixture	59
2-08	Treatment of Chlorinated Antibiotics by Oxidative/Reductive Species under Ionizing Radiation	60
2-09	Immobilization of Denitrifying Bacteria to HPC Gel Medium Synthesized by EB Irradiation	61
3.	Medical and Biotechnological Application	63
3-01	Estimation of Damage Localization in DNA Irradiated with Ionizing Radiations in Water	69
3-02	The Effect of Radiation Quality on Growth-medium Dependent Survival in <i>Escherichia coli</i>	70
3-03	Gamma-ray Sensitivity in <i>Arabidopsis thaliana</i> Exhibiting Different Flavonoid Accumulation Patterns	71
3-04	Target Irradiation of Individual Cells Using Focusing Heavy-ion Microbeam of JAEA-Takasaki (IV): An Improvement of Control Pathway of Scanned Beam Irradiation for "Actual" Cell Sample Irradiation	72
3-05	Microbeam Irradiation Response of the Salt Chemotaxis in Mock-conditioned <i>C. elegans</i>	73
3-06	Radiation-induced Bystander Cell-killing Effect is Dependant on Dose of Carbon Ions and γ -rays but Independent of LET	74
3-07	Mechanisms for the Induction of Radioadaptive Response by Radiation-induced Bystander Response	75
3-08	Analysis of Bystander Cell Signaling Pathway Activated by Heavy Ion-microbeam IV	76

3-09	Fluence-dependent Chromosomal Aberrations via Bystander Effect in Normal Human Fibroblasts Induced by C-, Ne- and Ar-ion Microbeams	77
3-10	Ion Beam Irradiation Has Different Influences on the Expression of Bax in Cultured Human Retinal Vascular Endothelial Cells Exposed to L-dopa among ^{20}Ne , ^{12}C , and ^4He	78
3-11	Radiosensitivity is Affected by the Dependence of DNA Double-strand Break Repair on LET	79
3-12	Epigenetic Modifier as a Potential Radiosensitizer for Heavy-ion Therapy on Malignancy	80
3-13	Apoptotic Cell Death of the Heavy Ion Irradiated Silkworm Egg after Cellular Blastoderm Stage	81
3-14	Promotion of Miss-differentiation of Testis-ova in p53 Deficient Medaka Testis by Micro-beam Irradiation of Carbon-ions	82
3-15	Polythene Chromosome Abberation as a Possible Marker for Assessing DNA Damage upon Ionizing Radiation in the Sleeping Chironomid Larvae	83
3-16	Effects of Carbon-ion Microbeam Irradiation on Pharyngeal Pumping in <i>Caenorhabditis elegans</i>	84
3-17	Electron-spin Relaxation Times of Irradiated Fructose Measured with Pulsed ESR	85
3-18	Relaxation Times of Radicals Induced in Irradiated Foods Using Pulse-ESR and CW-ESR	86
3-19	Three-dimensional Distribution Measurement of Eu in a <i>Paramecium Bursaria</i>	87
3-20	Approaches to Isolation and Culture of Mice LMECs, and Effects of Nicotine on Trace Elements Distribution in LMECs	88
3-21	Measurement of Fluorine Distribution in Root Dentin under Fluoride-containing Coating Materials	89
3-22	Imaging of Metallofullerene Distribution Using Micro-PIXE for Gadolinium NCT	90
3-23	Elemental Analysis of Lung Tissue Particles and Intracellular Iron Content of Alveolar Macrophages in Pulmonary Alveolar Proteinosis	91
3-24	Analysis of Erythrocytes in Hepatitis C Patients Treated with Peg-interferon Using In-Air Micro-PIXE	92
3-25	Trial for Targeting of Anticancer Drugs, Using Radiosensitive Immunolabelled Microcapsules	93
3-26	Development of Method for Plant Material Analysis by Micro-PIXE (Particle Induced X-ray Emission)	94
3-27	Sensitivity of Micro Beam PIXE System in TIARA for Several Trace Elements and Determination of Elemental Abundances in a Small Organism	95
3-28	Synthesis of Radiohalogen-labeled Peptide with High Affinity to HER2/neu Receptor	96

3-29	Complexation of Lutetium-177 with Bifunctional Chelators in the Presence of Competing Metals	97
3-30	Production of ¹³ N-labeled Nitrogen Gas Tracer for the Imaging of Nitrogen Fixation in Soybean Nodules	98
3-31	Analysis of the Effect of O ₂ Partial Pressure on Nitrogen Fixation in Soybean Plant Using Positron-emitting Tracer	99
3-32	RI Imaging Method to Analyze a Process of Radiocesium Contamination of Plants and to Develop Phytoremediation Techniques	100
3-33	Whole-plant Imaging of ¹⁰⁷ Cd Distribution Using Positron-emitting Tracer Imaging System	101
3-34	Development of Ion Beam Breeding Technology in Plants and Creation of Useful Plant Resources	102
3-35	Ion Beam Breeding of Rice for the Mutation Breeding Project of the Forum for Nuclear Cooperation in Asia (FNCA)	103
3-36	Generating New Chrysanthemum Plant Varieties Using Ion Beams	104
3-37	Mutational Effects of Carbon Ions near the Range End in Arabidopsis	105
3-38	Homologous Recombination Induced by Low-dose Radiations in Arabidopsis ..	106
3-39	Screening of Salt Tolerant Mutants by Combination of Radiation Mutagenesis and <i>In vitro</i> Regeneration in Lombardy Poplar (<i>Populus nigra</i>) ..	107
3-40	Effects of Gamma-ray Irradiation on Oxalate Metabolism in <i>Rumex obtusifolius</i> L.	108
3-41	Determination of the Carbon Ion Beam Irradiation Condition for Barley	109
3-42	Mutagenic Effect of Carbon Ion Beams in <i>Deinococcus radiodurans</i>	110
3-43	Genetic Analysis of Novel DNA Cross-link Repair Genes Common to <i>Deinococcus</i> and <i>Thermus</i>	111
3-44	Molecular Analysis of Heavy Ion Induced Mutations in Budding Yeast <i>S. cerevisiae</i>	112
3-45	Improvement of Endophytic Bacteria Using Ion Beams and Application of Bio-pesticide with Plant Growth Promoter Made from Oligo-chitosan	113
3-46	Identification of DNA Mutation Sites in a High Temperature Tolerant Mutant of <i>Bradyrhizobium japonicum</i> USDA110 Generated by Ion-beam Irradiation.....	114
3-47	Simultaneous Saccharification and Fermentation from Ionic Liquid-pretreated Biomass Using Ionic Liquid-tolerant Yeast Mutant	115
3-48	Benomyl-tolerant Mutation of Entomopathogenic Fungi Induced by Carbon Ion Beams	116
3-49	Mutation Analysis of High Ethyl Caproate Producing Sake Yeasts Generated by Ion Beam Breeding	117
3-50	Role of DNA Repair and Effect of Herbal Extract on LOH Induced by Ion Beam Radiations in <i>Saccharomyces cerevisiae</i>	118

4. Advanced Materials, Analysis and Novel Technology 119

4-01 Preparation of Gasochromic MoO₃ Films by Reactive Sputtering Deposition ... 123

4-02 1D Protein and Sugar Nanostructures by Single Particle Reactions 124

4-03 Formation of Ag Nanoparticles on Poly(vinylpyrrolidone) Nanowire
Fabricated by SPNT 125

4-04 Formation of Poly(vinylpyrrolidone) Nanofiber Containing Platinum Particles · 126

4-05 Production of Nano-sized Platinum-particle Films Using Low Energy
Electron Beams 127

4-06 Wetting Phenomena of Polycarbosilane Solution 128

4-07 Investigation of Permeation Mechanism through Zeolite Membranes by
Using Ion Beam Irradiation 129

4-08 Control of Spatial Crosslinking Reaction in Polymer Film by Ion and
Electron Beam Irradiation 130

4-09 Effect of Irradiation Ions on Critical Fluence of Changing to Amorphous
from Crystalline SiC Nanotubes 131

4-10 Thermo-Optic Switch Consisting of Mach-Zehnder Polymer Waveguide
Drawn Using Proton Beam Writing 132

4-11 Hydriding Property of Hydrogen Storage Alloy by Charged Particle Under
Different Irradiation Environment 133

4-12 Micropatterning on Fluoropolymer Surface Using Proton Beam Writing and
Nitrogen Ion Beam Irradiation 134

4-13 Fabrication of a Flexible Dielectrophoretic Device Using
Proton Beam Writing 135

4-14 Li-ion Battery Characterization by Ion Beam Analysis 136

4-15 Atomistic Transformation Processes Induced by the Interaction of
Implanted N-ions with Ti Thin Films 137

4-16 Ion Beam Analysis of Quaternary Heusler Alloy Co₂(Mn_{1-x}Fe_x)Si(111)
Epitaxially Grown on Ge(111) 138

4-17 Non-thermal Equilibrium Crystal Structure of FeRh Intermetallic Compound
Irradiated with Energetic Heavy Ions 139

4-18 Magnetic Patterning of FeRh Thin Films by Energetic Light Ion Microbeam
Irradiation and Their XMCD-PEEM Observation 140

4-19 Transmission Properties of a 4-MeV C⁺ Ion Beam Entering a
Curved Insulating Channel 141

4-20 Cathodoluminescence of He⁺-ion-implanted Feldspars 142

4-21 Control of Photoluminescent Properties of Si-O-C Materials by Irradiation of
Various Particle Beams 143

4-22 Contribution of Aeolian Dust in Ichinomegata Estimated from Electron Spin
Resonance Signal Intensity and Crystallinity of Quartz 144

4-23 Development of Spin-polarized Positron Beam and Its Application to
Spintronics Study 145

4-24	Complementary Study of Vacancy Defects in Si Substrates by Using SPM and EBIC Method	146
4-25	Positron Annihilation Lifetime Study of Cation Vacancies in Electroceramics ..	147
4-26	Yield of Transient Species in NaBr Aqueous Solution Irradiated with Pulsed H^+ , C^{5+} and Ne^{8+} Ions	148
4-27	Transient Absorption Spectra of Biphenyl-Dodecane Solution Measured by Microsecond Ion Pulse Radiolysis	149
4-28	Observation of Scintillation Behavior under Pulsed Ion Beam Irradiation	150
4-29	Solvent Effect on Copolymerization of Maleimide with Styrene Induced by Ion Beam Irradiation	151
4-30	Measurements of Low Energy Neutron Spectra Using the TOF Method in Quasi-monoenergetic Neutron Fields at TIARA	152
4-31	Measurement of Lineal Energy Distributions for Energetic Ion Beams Using a Wall-less Tissue Equivalent Proportional Counter	153
4-32	Fabrication of UV Curable Resin Based Microscopic Devices Using External Scanning Proton Microbeam	154
4-33	Preliminary Study on 3D Proton Lithography Using 300 kV Compact Focused Gaseous Ion Beam System	155
4-34	Research and Development of an Ultra-high-energy Neutrino Detector Using Radar Reflection in Rock Salt and Ice	156
4-35	Effect of Low Irradiation Temperature on the Gamma-ray Response of Clear Polymethylmethacrylate Dosimeter, Radix W	157
4-36	Analysis of Phase Bunching in AVF Cyclotron	158
4-37	Status Report on Technical Developments of Electrostatic Accelerators	159
4-38	Fast Single-ion Hit System for Heavy-ion Microbeam at TIARA Cyclotron (VI)	160
4-39	Development of a Microwave Ion Source for Industrial Applications	161
4-40	Beam Intensity Distribution Measurement Using a Fluorescent Screen for Formation of a Uniform Ion Beam	162
4-41	Response of Gafchromic Films to Energetic Ion Beams	163
4-42	Development of Scintillator for Detention of Single-ion	164
4-43	Focused Microbeam Irradiation Effects in Transmission CVD Diamond Film Detectors	165
4-44	Development of a New Ion Microbeam Analysis Technique: Ion Luminescence Microscopic Imaging and Spectroscopy	166
4-45	Coulomb Explosion Process in Collision of a Swift Cluster Ion with Gas Target	167
4-46	Study of Ion Induced Luminescence from Sapphire Irradiated with Swift Cluster Ion Beams	168
4-47	Electronic Stopping Power of Al and Si for Swift Carbon Cluster Ions with Average Charge Reduction	169

4-48	Comparison of Positive Secondary Ion Emission Yields for PMMA between Low Energy Bi and C ₆₀ Ion Impacts	170
4-49	Vicinage Effect on Secondary-electron Yield from Carbon Foils Bombarded with 62.5-250-keV/u H ₇ ⁺ and C ₇ ⁺ Ions	171
4-50	Production of Fast C ₆₀ Microbeam Using the Capillary-beam Focusing Method	172
4-51	Ion Tracks in Amorphous Si ₃ N ₄ Films Produced by Sub MeV C ₆₀ Ion	173
5.	Present Status of Irradiation Facilities 2011	175
5-01	Utilization Status at TIARA Facility	177
5-02	Operation of the AVF Cyclotron	178
5-03	Operation of Electrostatic Accelerators	179
5-04	Operation of the Electron Accelerator and the Gamma-ray Irradiation Facilities	180
5-05	Utilization Status of the Electron Accelerator and the Gamma-ray Irradiation Facilities	181
5-06	Radiation Control in TIARA	182
5-07	Radioactive Waste Management in TIARA	183
5-08	FACILITY USE PROGRAM in Takasaki Advanced Radiation Research Institute	184
	Appendices	185
	Appendix 1 List of Publication	186
	Appendix 2 List of Related Patents	205
	Appendix 3 List of Related Press-release and Television Broadcasting	207
	Appendix 4 Type of Research Collaboration and Facilities Used for Research	210
	Appendix 5 Examples of Typical Abbreviation Name for Organizations in Japan Atomic Energy Agency (JAEA)	212