

list of publications (April 2007~May 2020)

Fuel Safety Research Group

Journal papers :

- 1) V. Bessiron, T. Sugiyama and T. Fuketa, "Clad-to-Coolant Heat Transfer in NSRR Experiments," *J. Nucl. Sci. Technol.*, **44**[5], 723 (2007).
- 2) K. Tomiyasu, T. Sugiyama and T. Fuketa, "Influence of Cladding-Peripheral Hydride on Mechanical Fuel Failure under Reactivity-Initiated Accident Conditions," *J. Nucl. Sci. Technol.*, **44**[5], 733 (2007).
- 3) Y. Udagawa, M. Suzuki and T. Fuketa, "Analysis of MOX Fuel Behavior in Halden Reactor by FEMAXI-6 Code," *J. Nucl. Sci. Technol.*, **44**[8], 1070 (2007).
- 4) T. Kudo, M. Kida, T. Nakamura, et al., "Release of Cesium and Poorly Volatile Elements from UO₂ and MOX Fuels under Severe Accident Condition," *J. Nucl. Sci. Technol.*, **44**[11], 1421 (2007).
- 5) T. Kudo, M. Kida, T. Nakamura, et al., "Effects of Fuel Oxidation and Dissolution on Volatile Fission Product Release under Severe Accident Conditions," *J. Nucl. Sci. Technol.*, **44**[11], 1428 (2007).
- 6) M. Amaya, J. Nakamura and T. Fuketa, "Measurements on Crystal Lattice Strain and Crystallite Size in Irradiated UO₂ pellet by X-ray Diffractometry," *J. Nucl. Sci. Technol.*, **45**[3], 244 (2008).
- 7) M. Amaya, T. Sugiyama, F. Nagase, et al., "Fission Gas Release in BWR Fuel with a Burnup of 56 GWd/t during Simulated Reactivity Initiated Accident (RIA) Condition," *J. Nucl. Sci. Technol.*, **45**[5], 423 (2008).
- 8) M. Suzuki, T. Sugiyama and T. Fuketa, "Thermal Stress Analysis of High Burnup LWR Fuel Pellet Pulse-Irradiated in Reactivity-Initiated Accident Conditions," *J. Nucl. Sci. Technol.*, **45**[11], 1155 (2008).
- 9) T. Sugiyama, M. Umeda, T. Fuketa, et al., "Failure of High Burnup Fuels under Reactivity-initiated Accident Conditions," *Annals of Nuclear Energy* **36**, 380 (2009).
- 10) T. Chuto, F. Nagase and T. Fuketa, "High Temperature Oxidation of Nb-containing Zr Alloy Cladding in LOCA Conditions," *Nuclear Engineering and Technology*, **41**[2], 163 (2009).
- 11) F. Nagase, T. Sugiyama and T. Fuketa, "Optimized Ring Tensile Test Method and Hydrogen Effect on Mechanical Properties of Zircaloy Cladding in Hoop Direction," *J. Nucl. Sci. Technol.*, **46**[6], 545 (2009).
- 12) M. Amaya, J. Nakamura and T. Fuketa, "The Effects of Irradiation Condition and Microstructural Change on Lattice Parameter, Crystal Lattice Strain and Crystallite Size in High Burnup UO₂ Pellet," *J. Nucl. Mater.*, **392**, 439 (2009).
- 13) F. Nagase, T. Chuto and T. Fuketa, "Behavior of High Burn-up Fuel Cladding under LOCA Conditions," *J. Nucl. Sci. Technol.*, **46**[7], 763 (2009).
- 14) J. Nakamura, M. Amaya, F. Nagase and T. Fuketa, "Thermal Conductivity Change in High Burnup MOX Fuel Pellet," *J. Nucl. Sci. Technol.*, **46**[9], 944 (2009).

- 15) Y. Udagawa, M. Suzuki, T. Sugiyama and T. Fuketa, "Stress Intensity Factor at the Tip of Cladding Incipient Crack in RIA-Simulating Experiments for High Burnup PWR Fuels," *J. Nucl. Sci. Technol.*, **46**[10], 1012 (2009).
- 16) C. Vitanza and T. Fuketa, "Fuel Safety Limits: Experimental Results and Pending Questions," *EUROSAFE Tribune*, **16**, 13 (2009).
- 17) M. Amaya, J. Nakamura, T. Fuketa and Y. Kosaka, "Relationship between Changes in the Crystal Lattice Strain and Thermal Conductivity of High Burnup UO₂ Pellets," *J. Nucl. Mater.*, **396**, 32 (2010).
- 18) H. Sasajima, T. Sugiyama, T. Chuto, et al., "Identification of Radial Position of Fission Gas Release in High-Burnup Fuel Pellets under RIA Conditions," *J. Nucl. Sci. Technol.*, **47**[2], 202 (2010).
- 19) T. Sugiyama, Y. Udagawa and T. Fuketa, "Evaluation of Initial Temperature Effect on Transient Fuel Behavior under Simulated Reactivity-initiated Accident Conditions," *J. Nucl. Sci. Technol.*, **47**[5], 439 (2010).
- 20) Y. Udagawa, M. Yamaguchi, H. Abe, et al., "Ab Initio Study on Plane Defects in Zirconium-Hydrogen Solid Solution and Zirconium Hydride," *Acta Materialia*, **58**, 3927 (2010).
- 21) M. Amaya, V. Grismanovs and T. Tverberg, "Changes of the Surface-to-Volume Ratio and Diffusion Coefficient of Fission Gas in Fuel Pellets during Irradiation", *J. Nucl. Mater.*, **402**, 108 (2010).
- 22) M. Amaya, J. Nakamura, F. Nagase and T. Fuketa, "Thermal Conductivity Evaluation of High Burnup Mixed-oxide (MOX) Fuel Pellet", *J. Nucl. Mater.*, **414**, 303 (2011).
- 23) F. Nagase, "Hydride Behavior in Zircaloy Cladding Tube during High-temperature Transient", *J. Nucl. Mater.*, **415**, 117 (2011).
- 24) F. Nagase, "Behavior of LWR fuel during Loss-of-Coolant Accident", *Comprehensive Nuclear Materials*, **2**, 595 (2012).
- 25) Y. Udagawa, M. Yamaguchi, T. Tsuru, et al., "Effect of Sn and Nb on Generalized Stacking Fault Energy Surfaces in Zirconium and Gamma Hydride Habit Planes", *Philosophical Magazine*, **91**[12], 1665 (2011).
- 26) F. Nagase, T. Chuto and T. Fuketa, "Ring-compression Ductility of High Burn-up Fuel Cladding after Exposure to Simulated LOCA Conditions, *J. Nucl. Sci. Technol.*, **48**[11], 1369 (2011).
- 27) F. Nagase and H. Uetsuka, "Thermal Properties of THI-2 Core Debris and Simulated Debris", *J. Nucl. Sci. Technol.*, **49**[1], 96 (2012).
- 28) S. Hanawa, H. Ogiyanagi and M. Suzuki, "Verification of FEMAXI-7 Code by Using Irradiation Test in Halden Reactor for He-pressurization Effect on FGR of BWR Fuels under Power Transient", *J. Nucl. Sci. Technol.*, **49**(5), 516 (2012)
- 29) H. Ogiyanagi, S. Hanawa, M. Suzuki and F. Nagase, "FEMAXI-7 Analysis on Behavior of Medium and High Burnup BWR during Base-irradiation and Power Ramp", *Nucl. Eng. Des.*, **253**, 77 (2012).
- 30) T. Akie, I. Sato, M. Suzuki et al, "Simple Formula to Evaluate Helium Production Amount in Fast Reactor MA-containing MOX Fuel and Its Accuracy", *J. Nucl. Sci. Technol.*, **50**(1), 107 (2013)
- 31) T. Tsuru, Y. Udagawa, M. Yamaguchi, et al, "Solution Softening in Magnesium Alloys:

- The Effect of Solid Solutions on the Dislocation Core Structure and Nonbasal Slip”, *Journal of Physics: Condensed Matter*, **25**[2], 022202, (2013).
- 32) M. Suzuki, “JAEA summary report for FUMEX-III”, *IAEA TECDOC-1697*, (2013)
 - 33) Y. Udagawa, T. Sugiyama, M. Suzuki and F. Nagase, “Stress Biaxiality in High-Burnup PWR Fuel Cladding under Reactivity-Initiated Accident Conditions”, *J. Nucl. Sci. Technol.*, **50**[6], 645 (2013).
 - 34) M. Amaya and F. Nagase, “The Relationship Between the Amount of Oxidation and Activation Energy on the Steam Oxidation Reaction of Zircaloy-4 Cladding”, *J. Nucl. Mater.*, **440**, 457 (2013).
 - 35) M. Yamato, F. Nagase and M. Amaya, “Reduction in the Onset Time of Breakaway Oxidation on Zircaloy Cladding Ruptured under Simulated LOCA Conditions”, *J. Nucl. Mater.*, **445**, 78 (2014).
 - 36) Y. Udagawa, T. Mihara, T. Sugiyama, et al., “Simulation of the Fracture Behavior of Zircaloy-4 Cladding under Reactivity-Initiated Accident Conditions with a Damage Mechanics Model Combined with Fuel Performance Codes FEMAXI-7 and RANNS”, *J. Nucl. Sci. Technol.*, **51**[2], 208 (2013).
 - 37) M. Yamato, F. Nagase and M. Amaya, “Evaluation of Fracture Resistance of Ruptured, Oxidized, and Quenched Zircaloy Cladding by Four-Point-Bend Tests”, *J. Nucl. Sci. Technol.*, **51**[9], 1125 (2014).
 - 38) T. Usui, A. Sawada, M. Amaya, et al, “SiC Coating as Hydrogen Permeation Reduction and Oxidation Resistance for Nuclear Fuel Cladding”, *J. Nucl. Sci. Technol.*, **52**[10], 1318 (2015).
 - 39) T. Narukawa and M. Amaya, “The Effect of Oxidation and Crystal Phase Condition on the Ballooning and Rupture Behavior of Zircaroy-4 Cladding Tube under Transient-heating Conditions”, *J. Nucl. Sci. Technol.*, **53**[1], 112 (2015).
 - 40) T. Shinozaki, Y. Udagawa, T. Mihara et al, “Improved-EDC Tests on the Zircaloy-4 Cladding Tube with an Outer Surface Pre-crack”, *J. Nucl. Sci. Technol.*, **53**[9], 1426 (2015).
 - 41) H. Wu, Y. Udagawa, T. Narukawa, M. Amaya, “Validation of Updated RANNS with Effect of Oxygen-dissolved Metallic Zircaloy-4 under LOCA Quench Condition”, *Nucl. Eng. Des.*, Vol.300, pp.249-255, (2016).
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 - 43) H. Wu, Y. Udagawa, T. Narukawa, M. Amaya, “Crack Formation in Cladding under LOCA Quench Conditions”, *Nucl. Eng. Des.*, Vol.303, pp.25-30 (2016).
 - 44) H. Miwa, M. Amaya, “The Effect of Oxidation-and-Quenching During a LOCA on the Behavior of the Oxidation and Embrittlement of Zircaloy-4 Cladding under Reheating transients” *J. Nucl. Sci. Technol.*, Vol.53, No.12, pp.2090-2097 (2016).
 - 45) M. Negyesi, M. Amaya, “Oxidation kinetics of Zry-4 fuel cladding in mixed steam-air atmospheres at temperatures of 1273–1473 K”, *J. Nucl. Sci. Technol.*, Vol.54, No.10, pp.1143-1155 (2017).
 - 46) D. Komiyama, M. Amaya, “The fracture behaviors of non-irradiated zircaloy-4 fuel cladding with a pinhole under simulated LOCA conditions”, *J. Nucl. Sci. Technol.*, Vol.54,

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- 47) T. Narukawa, A. Yamaguchi, S. Jang, M. Amaya, “Experimental and Statistical Study on Fracture Boundary of Non-irradiated Zircaloy-4 Cladding Tube under LOCA Conditions”, *J. Nucl. Mater.*, Vol.499, pp.528-538 (2018).
- 48) T. Mihara, Y. Udagawa, M. Amaya, “Deformation Behavior of recrystallized and Stress-relieved Zircaloy-4 Fuel Cladding under Biaxial Stress Conditions”, *J. Nucl. Sci. Technol.*, Vol.55, No.2, pp.151-159 (2018).
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- 50) T. Narukawa, A. Yamaguchi, S. Jang, M. Amaya, “Uncertainty Quantification of Fracture Boundary of Pre-hydrated Zircaloy-4 Cladding Tube under LOCA Conditions”, *Nucl. Eng.Des.*, **331**, 147, (2018)
- 51) T. Fuketa, F. Nagase, “Behavior of Fuel with Zirconium Alloy Cladding in Reactivity-Initiated Accident and Loss-of-Coolant Accident”, *J. ASTM STP*, **1597**, 52, DOI 10.1520/STP159720160090 (2018)
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- 53) F. Li, T. Mihara, Y. Udagawa, M. Amaya, “The Effect of Hydride Morphology on the Failure Strain of Stress-Relieved Zircaloy-4 Cladding with an Outer Surface Pre-crack under Biaxial Stress States”, *J. Nucl. Sci. Technol.*, **56**[5], 432 (2019)
- 54) Y. Udagawa, M. Amaya, “Model Updates and Performance Evaluations on Fuel Performance Code FEMAXI-8 for Light Water Reactor Fuel Analysis”, *J. Nucl. Sci. Technol.*, **56**[6], 461 (2019)
- 55) T. Narukawa, M. Amaya, “Oxidation behavior of high-burnup advanced fuel cladding tubes in high-temperature steam”, *J. Nucl. Sci. Technol.*, **56**[7], 650 (2019)
- 56) T. Mihara, Y. Udagawa, M. Amaya, “Fracture Behavior of Recrystallized and Stress-Relieved Zircaloy-4 Cladding under Biaxial Stress Conditions”, *J. Nucl. Sci. Technol.*, **56**[8], 724 (2019)
- 57) Y. Udagawa, T. Sugiyama, M. Amaya, “Thresholds for Failure of High-Burnup LWR Fuels by Pellet Cladding Mechanical Interaction under Reactivity-Initiated Accident Conditions”, *J. Nucl. Sci. Technol.*, **56**[12], 1063 (2019)
- 58) M. Negyesi, M. Amaya, “The Effect of air Fraction in Steam on the Embrittlement of Zry-4 Fuel Cladding Oxidized at 1273-1573 K”, *Oxidation of Metals*, **92**[5-6], 439 (2019)
- 59) M. Negyesi, M. Amaya, “The Effect of nitride formation on the oxidation kinetics of Zry-4 fuel cladding under steam-air atmospheres at 1273-1573 K”, *J. Nucl. Mater.*, **524**, 263, (2019)
- 60) Y. Udagawa, T. Fuketa, “Transient Response of LWR Fuels (RIA)”, Reference Module in Materials Science and Materials Engineering, Elsevier, Online-published (2019)
- 61) T. Narukawa, M. Amaya, “Fracture Limit of High-Burnup Advanced Fuel Cladding Tubes under Loss-Of-Coolant Accident Conditions”, *J. Nucl. Sci. Technol.*, **57**[1], 68 (2020)

- 62) Y. Okada, M. Amaya, “Effects of oxidation and secondary hydriding during simulated Loss-Of-Coolant-Accident tests on the bending strength of Zircaloy-4 fuel cladding tube”, *Ann. Nucl. Energy*, **136**, 107028_1, (2020)
- 63) Y. Udagawa, T. Mihara, Y. Taniguchi, K. Kakiuchi, M. Amaya, “The Effect of Base Irradiation on Failure Behaviors of UO₂ and Chromia-Alumina Additive Fuels under Simulated Reactivity-Initiated Accidents; A Comparative Analysis with FEMAXI-8”, *Ann. Nucl. Energy*, **139**, 107268_1, (2020)
- 64) Y. Taniguchi, Y. Udagawa, M. Amaya, “Analytical Study of SPERT-CDC Test 859 Using Fuel Performance Codes FEMAXI-8 and RANNS”, *Ann. Nucl. Energy*, **139**, 107188_1, (2020)
- 65) F. Li, T. Mihara, Y. Udagawa, M. Amaya, “Fracture-mechanics-based evaluation of failure limit on pre-cracked and hydrided Zircaloy-4 cladding tube under biaxial stress states”, *J. Nucl. Sci. Technol.*, **57**[6], 633 (2020)

Technical reports (International only):

- 1) N. Tregoures and T. Sugiyama, “FGD Program : Status of Fission Gas Dynamics Programme”, IRSN technical report, DPAM-SEMCA-2008-330, (2008).
- 2) V. Georgenthum and T. Sugiyama, “FGD Program : SCANAIR Preparatory Calculations”, IRSN technical report, DPAM-SEMCA-2010-288, (2010).
- 3) M. Suzuki, H. Saito, Y. Udagawa and F. Nagase, “Light Water Reactor Fuel Analysis Code FEMAXI-7; Model and Structure”, JAEA-Data/Code 2013-005 (2013).
- 4) M. Suzuki, H. Saito, Y. Udagawa and F. Nagase, “Input/Output Manual of Light Water Reactor Fuel Analysis Code FEMAXI-7 and Its Related Codes”, JAEA-Data/Code 2013-009, (2013).
- 5) Y. Udagawa, T. Sugiyama and M. Amaya, “Heat Transfer from Fuel Rod Surface under Reactivity-Initiated Accident Conditions – NSRR Experiments Under Varied Cooling Conditions –”, JAEA-Data/Code 2013-021 (2013).

Reports on international conferences:

- 1) Y. Udagawa, M. Suzuki, T. Sugiyama, et al., “Development of Two Dimensional Mechanical Model to Analyze Pellet/Cladding Interaction during a Reactivity-Initiated Accident,” Proc. 2007 Enlarged Halden Programme Group Meeting, Storefjell, Norway, March, 2007.
- 2) T. Suzuki and M. Umeda, “Development of High Temperature Capsule for RIA-simulating Experiment with High Burnup Fuel,” Proc. Research Reactor Fuel Management (RRFM)/ International Group Operating Research Reactors (IGORR), Lyon, France, March 11-15, 2007.
- 3) Y. Muramatsu and Y. Udagawa, “Instrumentation Techniques in NSRR Experiments,” Proc. IAEA Technical Meeting on Fuel Rod instrumentation and In-Pile Measurement Techniques, Halden, Norway, 3-5 September, 2007.
- 4) T. Fuketa, T. Sugiyama, F. Nagase, et al., “JAEA Studies on High Burnup Fuel

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- 5) T. Kudo, “VEGA Program on Radionuclide Release from Fuel”, International VERCORS Seminar, Greoux les Bains, France, October, 2007.
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 - 7) T. Sugiyama, M. Umeda, T. Fuketa, et al., “Failure of High Burnup Fuels under Reactivity-initiated Accident Conditions,” Proc. International Conference on the Physics of Reactors (PHYSOR 2008), Interlaken, Switzerland, September 14-19, 2008.
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 - 9) G. Khvostov, M. Zimmermann, T. Sugiyama and T. Fuketa, “On the Use of the FALCON Code for Modeling the Behaviour of High Burn-up BWR Fuel during the LS-1 Pulse-Irradiation,” Proc. PHYSOR 2008, Interlaken, Switzerland, September 14-19, 2008.
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 - 11) T. Sugiyama, Y. Udagawa, M. Umeda et al., “PWR Fuel Behavior in RIA-simulating Experiment at High Temperature,” Proc. 2008 Water Reactor Fuel Performance Meeting (WRFPM), Seoul, Korea, October 19-22, 2008.
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 - 13) Y. Udagawa, T. Sugiyama, M. Suzuki, et al., “Cladding Stress Biaxiality in Reactivity Initiated Accident Conditions,” Proc. WRFPM 2008, Seoul, Korea, October 19-22, 2008.
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 - 17) M. Suzuki, “Fission Gas Release during Power Change (Re-irradiation Test of LWR Fuel Rod at JMTR),” IAEA TECDOC (IAEA/FUMEX-3 Program Meeting), Vienna, Austria, December, 2008.
 - 18) T. Fuketa, T. Sugiyama, M. Umeda, et al., “Behavior of LWR/MOX Fuels under Reactivity-Initiated Accident Conditions,” Proc. of Top Fuel 2009, Paris, France, September, 2009.
 - 19) M. Suzuki, T. Sugiyama, Y. Udagawa, et al., “Comparative Analysis on Behavior of High

- Burnup PWR Fuel Pulse-Irradiated in Reactivity-Initiated Accident Conditions,” Proc. of Top Fuel 2009, Paris, France, September, 2009.
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 - 26) V. Georghentum and T. Sugiyama, “Influence on Initial Conditions on Rod Behaviour during Boiling Crisis Phase Following a Reactivity Initiated Accident,” Proc. of the OECD/NEA Workshop on Nuclear Fuel Behaviour during Reactivity Initiated Accident, Paris, France, September, 2009.
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 - 31) M. Suzuki and S. Hanawa, “PCMI Analysis on NSRR RIA Experiments FK-1 and FK-2 by RANS Code”, IAEA CRP FUMEX-III 2nd Workshop, Pisa, Italy, June 1-4, 2010.
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- 37) F. Nagase, T. Sugiyama, M. Amaya et al., "Failure Behavior of LWR Fuel Cladding under Accident Conditions, Key Observations from Fuel Safety Research Program at JAEA", 1st Asian Zirconium Workshop, Daejeon, South Korea, June, 2011.
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- 42) T. Fukuda, "The Cladding Fracture Behavior under Biaxial Stress Condition", Proc. of the IAEA Technical Meeting on Fuel Behavior under Modeling under Severe Transient and LOCA Conditions, Mito, Japan, October, 2011.
- 43) M. Suzuki, Y. Udagawa, T. Sugiyama and F. Nagase, "Present Status of the Verifications and Model Development of FEMAXI and RANNS Codes in JAEA", Proc. of the IAEA Technical Meeting on Fuel Behavior under Modeling under Severe Transient and LOCA Conditions, Mito, Japan, October, 2011.
- 44) T. Mihara, T. Fukuda, Y. Udagawa et al., , "Fracture Behavior of Hydrided Cladding Tubes with Radial Incipient Crack in Periphery", Proc. of the IAEA Technical Meeting on Fuel Behavior under Modeling under Severe Transient and LOCA Conditions, Mito, Japan, October, 2011.
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