



Contents

Review Articles

Nuclear Fuel Cycle and Radioactive Waste Management

- Reprocessing of spent nuclear fuel in carbonate media: Problems, achievements, and prospects
Sergei I. Stepanov, and Alexander V. Boyarintsev2339

Original Articles

Nuclear Fuel and Reactor Materials

- Comparison of the effects of irradiation on iso-molded, fine grain nuclear graphites: ETU-10, IG-110 and NBG-25
Se-Hwan Chi2359

- Physics-based modelling and validation of inter-granular helium behaviour in SCIENTIX
R. Giorgi, A. Cechet, L. Cognini, A. Magni, D. Pizzocri, G. Zullo, A. Schubert, P. Van Uffelen, and L. Luzzi2367

- Inclusion and mechanical properties of ODS-RAFM steels with Y, Ti, and Zr fabricated by melting
Guo-xing Qiu, Xu-li Wei, Chong Bai, De-jun Miao, Lei Cao, and Xiao-ming Li2376

- Effect of strain rate and stress triaxiality on fracture strain of 304 stainless steels for canister impact simulation
Jun-Min Seo, Hune-Tae Kim, Yun-Jae Kim, Hiroyuki Yamada, Tomohisa Kumagai, Hayato Tokunaga, and Naoki Miura2386

- Application of the SCIENTIX fission gas behaviour module to the integral pin performance in sodium fast reactor irradiation conditions
A. Magni, D. Pizzocri, L. Luzzi, M. Lainet, and B. Michel2395

- Effect of irradiation temperature on the nanoindentation behavior of P92 steel with thermomechanical treatment
Xi Huang, Yinzhang Shen, Qingshan Li, Xiaoyan Li, Zixiong Zhan, Guang Li, and Zhenhe Li2408

Nuclear Fuel Cycle and Radioactive Waste Management

- Verification of the adequacy of domestic low-level radioactive waste grouping analysis using statistical methods
Dong-Ju Lee, Hyunjong Woo, Dae-Seok Hong, Gi Yong Kim, Sang-Hee Oh, Wonjun Seong, Junhyuck Im, and Jae Hwan Yang2418

- Order-disorder structural tailoring and its effects on the chemical stability of (Gd, Nd)₂(Zr, Ce)₂O₇ pyrochlore ceramic for nuclear waste forms
Yan Wang, Jin Wang, Xue Zhang, Nan Li, Junxia Wang, and Xiaofeng Liang2427

Nuclear I&C

- Design of digital nuclear power small reactor once-through steam generator control system
Hong Qian, and Mingyao Zou2435

- FPGA integrated IEEE 802.15.4 ZigBee wireless sensor nodes performance for industrial plant monitoring and automation
Ompal, Vishnu Mohan Mishra, and Adesh Kumar2444

- Concept of an intelligent operator support system for initial emergency responses in nuclear power plants
Jung Sung Kang, and Seung Jun Lee2453





An International Journal of the Korean Nuclear Society

NUCLEAR ENGINEERING AND TECHNOLOGY

Volume 54, Number 7, July 2022

Contents

Nuclear Policy, Economics and Human Resource Development

- Thinking multiculturalism in the age of hybrid threats: Converging cyber and physical security in Akkuyu nuclear power plant
A. Salih Bıçakcı, and Ayhan Gücüyener Evren2467

Nuclear Safety

- Performance evaluation of Accident Tolerant Fuel under station blackout accident in PWR nuclear power plant by improved ISAA code
Bin Zhang, Pengcheng Gao, Tao Xu, Miao Gui, and Jianqiang Shan2475
- Application and optimal design of the bionic guide vane to improve the safety serve performances of the reactor coolant pump
Haoran Liu, Xiaofang Wang, Yeming Lu, Yongqi Yan, Wei Zhao, Xiaocui Wu, and Zhigang Zhang2491
- Correlation between events with different safety significance in nuclear power plants
Zdenko Šimić, Miguel Peinador Veira, and Reni Banov2510
- Effects of child pick-up behavior on emergency evacuations
Sang Hoon Jang, Ha Hwang, and Ji-Bum Chung2519

Nuclear Structural Analysis /Plant Management & Maintenance

- Preliminary strong ground motion simulation at seismic stations within nuclear power plant sites in South Korea by a scenario earthquake on the causative fault of 2016 Gyeongju earthquake
Hoseon Choi2529
- Research on the inlet preswirl effect of clearance flow in canned motor reactor coolant pump
Rui Xu, Yuchen Song, Xiyao Gu, Bin Lin, and Dezhong Wang2540
- Precise dynamic finite element elastic-plastic seismic analysis considering welds for nuclear power plants
Jong-Sung Kim, and Hyun-Su Jang2550

Radiation Application

- The detection efficiency study of NaI(Tl) scintillation detector with the different numbers of SiPMs
Bao Wang, Xiongjie Zhang, Qingshan Wang, Dongyang Wang, Dong Li, Mingdong Xiahou, Pengfei Zhou, Hao Ye, Bin Hu, and Lijiao Zhang2564
- Evaluation of cadmium ratio for conceptual design of a cyclotron-based thermal neutron radiography system
Weng-Sheng Kuo2572
- Towards effective indirect radioisotope energy converters with bright and radiation hard scintillators of (Gd,Y)₃Al₂Ga₃O₁₂ family
M. Korzhik, R. Abashev, A. Fedorov, G. Dosovitskiy, E. Gordienko, I. Kamenskikh, D. Kazlou, D. Kuznecova, V. Mechinsky, V. Pustovarov, V. Retivov, and A. Vasil'ev2579
- Deuterium ion irradiation impact on the current-carrying capacity of DI-BSCCO superconducting tape
M. Rajput, H.L. Swami, R. Kumar, A. Bano, S. Vala, M. Abhangi, Upendra Prasad, Rajesh Kumar, and R. Srinivasan2586
- Optimized TOF-PET detector using scintillation crystal array for brain imaging
Hyuntae Leem, Yong Choi, Jiwoong Jung, Kuntai Park, Yeonkyeong Kim, and Jin Ho Jung2592



Contents

Radiation Protection

- Reference dosimetry for inter-laboratory comparison on retrospective dosimetry techniques in realistic field irradiation experiment using ^{192}Ir
 Yoomi Choi, Hyoungtaek Kim, Min Chae Kim, Hyungjoon Yu, Hyunseok Lee, Jeong Tae Lee, Hanjin Lee, Young-su Kim, Han Sung Kim, and Jungil Lee2599
- Evaluation of radiological safety according to accident scenarios for commercialization of spent resin mixture treatment device
 Woo Nyun Choi, Jaehoon Byun, and Hee Reyoung Kim.....2606
- Comparative optimization of Be/Zr(BH₄)₄ and Be/Be(BH₄)₂ as ^{252}Cf source shielding assemblies: Effect on landmine detection by neutron backscattering technique
 Nassreldeen A.A. Elsheikh.....2614

Reactor Physics

- Goal-oriented multi-collision source algorithm for discrete ordinates transport calculation
 Wang Xinyu, Zhang Bin, and Chen Yixue2625
- Neutronic simulation of the CEFRE experiments with the nodal diffusion code system RAST-F
 Tuan Quoc Tran, and Deokjung Lee.....2635
- Beam-target configurations and robustness performance of the tungsten granular flow spallation target for an Accelerator-Driven Sub-critical system
 Han-Jie Cai, Huan Jia, Xin Qi, Ping Lin, Sheng Zhang, Yuan Tian, Yuanshuai Qin, Xunchao Zhang, Lei Yang, and Yuan He2650
- Assessment of the material attractiveness and reactivity feedback coefficients of various fuel cycles for the Canadian concept of Super-Critical Water Reactors
 Remon Ibrahim, Adriaan Buijs, and John Luxat.....2660
- Analysis of several VERA benchmark problems with the photon transport capability of STREAM
 Nhan Nguyen Trong Mai, Kyeongwon Kim, Matthieu Lemaire, Tung Dong Cao Nguyen, Woonghee Lee, and Deokjung Lee.....2670
- Numerical studies on the important fission products for estimating the source term during a severe accident
 Yoonhee Lee, Yong Jin Cho, and Kukhee Lim2690

Thermal Hydraulics

- Separate and integral effect tests of aerosol retention in steam generator during tube rupture accident
 Byeonghee Lee, Sung-Il Kim, and Kwang Soon Ha.....2702
- Analytical model of transverse pressure loss in a rod array
 Guillaume Ricciardi, Jean Peybernes, and Vincent Faucher2714
- Study on flow characteristics in LBE-cooled main coolant pump under positive rotating condition
 Yonggang Lu, Zhengwei Wang, Rongsheng Zhu, Xiuli Wang, and Yun Long2720
- Thermal-hydraulic research on rod bundle in the LBE fast reactor with grid spacer
 Jie Liu, Ping Song, Dalin Zhang, Shibao Wang, Chao Lin, Yapeng Liu, Lei Zhou, Chenglong Wang, Wenxi Tian, Suizheng Qiu, and G.H. Su2728

Contents

Technical Notes

Radiation Protection

- A study on pressurizer cutting scenario for radiation dose reduction for workers using VISIPLAN
Hak Yun Lee, Sun Il Kim, and Jong Soon Song2736

Radiation Application

- Feasibility study of β -ray detection system for small leakage from reactor coolant system
Jaeyeong Jang, Jae Young Jeong, Junesic Park, Young-Sik Cho, Kihong Pak, and Yong Kyun Kim2748