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INTERNATIONAL CONFERENCE ON NUCLEAR DATA FOR SCIENCE AND TECHNOLOGY

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CONFERENCE PROGRAM & ABSTRACT BOOK

Tue May 21 14:00-17:50 Room 305

Topic Track: Nuclear Data Application
Session Title: Application in Nuclear Reactor 3
Chair: Tamara Korbut

14:00	I158	**A New Reference Database for Beta-delayed Neutron Data for Applications** / Paraskevi Dimitriou (International Atomic Energy Agency, On behalf of the IAEA CRP, Austria)
14:30	R159	**On-the-fly Temperature-dependent Cross Section Treatment Under Extreme Conditions in RMC Code** / Lei Zheng (Department of Engineering Physics, Tsinghua Uni., China)
14:50	R160	**Evolution of the Importance of Neutron-induced Reactions Along the Cycle of An LFR** / Pablo Romojaro (CIEMAT, Spain)
15:10	R161	**Benchmarking the New ENDF/B-VIII.0 Nuclear Data Library for OECD/NEA Medium 1000 MWth Sodium-cooled Fast Reactor** / Donny Hartanto (Uni. of Sharjah, UAE, United Arab Emirates)
15:30	R162	**Measurement of Temperature-dependent Thermal Neutron Spectrum in CaH2 Moderator Material for Space Reactor Using TOF Method** / Jaehong Lee (Ins. for Intergrated Radiation and Nuclear Science, Kyoto Unversity, Japan)
15:50		**Break**

Topic Track: Nuclear Data Application
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16:10	R163	**Production and Verification of the Compressed Depletion Data Library for Neutronic Analysis** / Yunfei Zhang (Harbin Engineering Uni., China)
16:30	R164	**Benchmarking the New ENDF/B-VIII.0 Nuclear Data Library for the First Core of Indonesian Multipurpose Research Reactor (RSG-GAS)** / Donny Hartanto (Uni. of Sharjah, UAE, United Arab Emirates)
16:50	R165	**Nuclear Data Sensitivity and Uncertainty Analyses on the First Core Criticality of the RSG Gas Multipurpose Research Reactor** / Peng Hong Liem (Tokyo City Uni., Japan)
17:10	R166	**On the Impact of Nuclear Data Uncertainties on LWR Neutron Dosimetry Assessments** / Dimitri Rochman (Paul Scherrer Institut, Switzerland) / Speaker: Erwin Alhassan
17:30	R167	**Nuclear Data Sensitivity Analysis and Uncertainty Propagation in the KYADJ Whole-core Transport Code** / Qu Wu (Nuclear Power Ins. of China)

R161 Benchmarking the New ENDF/B-VIII.0 Nuclear Data Library for OECD/NEA Medium 1000 MWth Sodium-cooled Fast Reactor

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This paper presents the benchmark evaluation of the new ENDF/B-VIII.0 nuclear library for the OECD/NEA Medium 1000 MWth Sodium-cooled Fast Reactor (SFR). There are 2 SFR cores: metallic fueled (MET-1000) and oxide fueled (MOX-1000). The continuous-energy Monte Carlo codes Serpent 2 will be used as the calculation tools. Several nuclear libraries such as ENDF/B-VII.1 and JENDL-4.0 will be included to be compared with the newest ENDF/B-VIII.0. The evaluated parameters are k-eff, beta-eff, sodium void reactivity ($\triangle\rho$Na), Doppler constant ($\triangle\rho$Doppler), control rod worth ($\triangle\rho$CR), and radial power distribution.

R162 Measurement of Temperature-dependent Thermal Neutron Spectrum in CaH2 Moderator Material for Space Reactor Using TOF Method

Jaehong Lee[1], Tadafumi Sano [1], Jun-ichi Hori [1], Rei Kimura[2], Takayuki Sako [2], Akira Yamada[2], Jun Nishiyama[3]
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In order to power the space exploration such as human missions to the moon and Mars, the small high-temperature nuclear reactor using a solid moderator has been proposed as a space power system. As a solid moderator, the calcium-hydride (CaH2) having a high melting point, 816 °C, is suggested for the high-temperature operation.

Because neutronics characteristics is changed by the increase of temperature, the reactivity of the CaH2 moderated space reactor is greatly contributed to the temperature-dependent thermal neutron spectrum in the moderator. Nevertheless, the evaluated nuclear data and experimental data of the CaH2 is not satisfied in quality and quantity. Therefore, in order to accurately design the reactor, it is necessary to experimentally confirm the temperature-dependent thermal neutron spectrum in the CaH2.

In the present study, we have focused on the measurement of the temperature-dependent thermal neutron spectrum in the CaH2. To obtain the temperature-dependent thermal neutron spectrum, we have carried out the neutron scattering experiment using the time-of-flight (TOF) method at the Kyoto University Institute for Integrated Radiation and Nuclear Science - Linear Accelerator (KURNS-LINAC). In present experiment, we raised the temperature of the CaH2 from a room temperature to 500 °C, and obtained the change of the thermal neutron spectrum for the increase of temperature.

The obtained temperature-dependent thermal neutron spectrum in the CaH2 is compared with the calculated result using the Monte-Carlo simulation with JENDL-4.0.

R163 Production and Verification of the Compressed Depletion Data Library for Neutronic Analysis

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The depletion calculation based on the explicit depletion library can accurately describe the revolution of reactor composition, However, it requests large computing cost in reactor physics calculation. In this paper, a high-fidelity compression depletion library is produced based on quantitative significance analysis. In PWR problem, the effects of each unit compression operation on neutron absorption, neutron output, and target nuclide nuclear number density are investigated. For the compressed library, a series of benchmark problems are used to verification. The results show that the simplified library can significantly reduce the burn-up chain scale and save computing resources, while meeting the calculation accuracy requirement.

R164 Benchmarking the New ENDF/B-VIII.0 Nuclear Data Library for the First Core of Indonesian Multipurpose Research Reactor (RSG-GAS)

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The Indonesian Multipurpose Research Reactor namely Reaktor Serba Guna G.A. Siwabessy (RSG GAS) is a 30 MWth (max.) pool-type reactor loaded with plate-type low-enriched uranium fuel, using light water as coolant and moderator, and beryllium as reflector. The benchmark of the 1st criticality core of RSG GAS using different nuclear data libraries such as JENDL-4.0, JENDL-3.3, ENDF/B-VII.0, and JEFF-3.1 have been performed in the previous work and compared with the experiment result. In this work, the newly released ENDF/B-VIII.0 neutron reaction and thermal neutron scattering libraries will be used and the important neutronics parameters such as multiplication factor, kinetics parameters, and fission reaction rate will be calculated using Monte Carlo code MCNP6.2 and compared against the previous work and the experiment result.

R165 Nuclear Data Sensitivity and Uncertainty Analyses on the First Core Criticality of the RSG Gas Multipurpose Research Reactor

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The results of criticality, sensitivity and uncertainty (S/U) analyses on the first core criticality of the Indonesian 30 MWth Multipurpose Reactor RSG GAS (MPR-30) using the recent nuclear data libraries (ENDF/B-VII.1 and JENDL-4.0) and analytical tools available at present (WHISPER-1.1) are presented. Two groups of criticality benchmark cases were carefully selected from the experiments conducted during the first criticality approach and control rod calibrations. The C/E values of effective neutron multiplication factor (k) for the worst case was found around 1.005. Large negative sensitivities were found in (n,γ) reaction of H-1, U-235, Al-27, U-238 and Be-9 while large positive sensitivities were found in U-235 (total nu and fission), H-1 (elastic), Be-9 (free gas, elastic) and H-1 S(α,β) (lwtr.20t, inelastic). The energy dependency of the sensitivities were also presented and discussed in detail. The S/U analysis results concluded that the uncertainties of k originated from the nuclear data were found around 0.6% which covered well the [C/E-1] values. Differences in the sensitivities amongst the two nuclear data libraries were also identified, and recommendation for improving the nuclear data library was given.

R166 On the Impact of Nuclear Data Uncertainties on LWR Neutron Dosimetry Assessments

Dimitri Rochman, Alexander Vasiliev, Hakim Ferroukhi
Paul Scherrer Institut

In this work, an overview on the relevance of the nuclear data (ND) uncertainties with respect to the Light Water Reactors (LWR) neutron dosimetry is presented. The paper summarizes findings and observations accumulated on the basis of several studies realized at the LRT (former LRS) laboratory of the Paul Scherrer Istitute over the past decade. The studies were done using the base LRT calculation methodology for dosimetry assessments, which involves the neutron source distribution representation, obtained based on validated CASMO/SIMULATE calculation models, and the consequent neutron transport simulations with the MCNP code. The methodology was validated using as the reference data the results of numerous measurement programs realized at Swiss NPPs and at PSI Hotlab. Namely, the following experimental programs are considered in the given overview: PWR RPV scraping tests and PWR "gradient probes" post irradiation examination (PIE) data and BWR reactor fast neutron fluence monitors dosimetry PIE data.

The assessment of the nuclear data related uncertainties was performed with the help of calculation tools and methodologies developed and maintained at LRT, which in principle can cover the complete calculation chain from the cycle-specific core-follow calculations to the neutron transport and finally to the dosimetry reaction rates calculations. However, so far the above uncertainty components were mainly analyzed separately from each other in order to facilitate the separate tools development and associated V&V studies. When appropriate, the results of the cross-verification of the different ND uncertainty quantification tools and techniques realized at LRT will be discussed too.

Furthermore, the findings on which particular neutron induced reactions contribute dominantly to the overall ND-related uncertainties will be presented. In addition, the magnitude of the ND-related uncertainties will be assessed against other types of typical modeling and experimental uncertainties based on the information available at LRT. Thus, the collected results should be sufficiently representative to assess the overall impact of the various nuclear data uncertainties with respect to the practical reactor dosimetry applications and provide relevant feedback to the nuclear data evaluators.