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Abstract Collection

Sunny Ineza Putri, Prihadi Setyo Darmanto, Raden Mohammad Subekti., *Design of Helical Type Steam Generator for Experimental Power Reactor.*, Tri Dasa Mega, 25 (1), 1.

Reaktor Daya Eksperimental (RDE) is a high-temperature gas-cooled reactor (HTGR) for electricity generation, heat generation, and hydrogen production by BATAN. Empirical and numerical calculations are needed to strengthen the existing design. The numerical method by computational fluid dynamic (CFD) analyzes temperature distribution and pressure drop along the pipe. The BATAN RDE steam generator design has a seven-layer helical pipe model, while this research uses a one-layer helix pipe. In empirical calculations, the heat transfer region has three sections; single-phase liquid, two-phase, and single-phase vapor heat transfer. In numerical calculations, applied constant heat flux and constant working fluid properties. The results of empiric calculations data showed that the helical pipe height was 3.98 m, shorter than the BATAN design, which is 4.97 m. This considerable difference is due to empirical calculations, which did not cover the safety factor. The results of numerical calculations show that in the single-phase, empiric calculation data were acceptable since the different values of numerical calculations for empiric calculation data were below 10%. Meanwhile, the case of the two-phase numerical calculations is not satisfactory and needs further research to obtain optimal results.

Keywords: HTGR, Steam generator, Helical pipe, Empirical calculation, CFD

Soni Prayogi, Zainuddin., *Gamma Radiation Effects on the Performance of Mono-crystalline Solar Cells.*, Tri Dasa Mega, 25 (1), 9.

In this study, we present examples of solar cells that were subjected to various levels of 60Co gamma radiation. The solar cells we use are mono-crystalline, which has a stable crystal structure and high efficiency compared to polycrystalline. Prior to and during gamma irradiation, the current-voltage characteristics of monocrystalline silicon solar cells under AM1.5 light conditions and their photon spectral currents were examined. The results of the experiment demonstrate that as the dose of gamma radiation increases, solar cell metrics including open circuit voltage (Voc), short circuit current (Isc), and efficiency (η) drop. The photon spectral current demonstrates that as dose gamma is increased, the current decreases at shorter wavelengths and the defects are primarily produced near the solar cell's surface. Our findings demonstrate the gamma irradiation-induced breakdown of silicon solar cells and the minority carrier lifetime which demonstrates that the minority carrier lifetimes sharply decline with increasing radiation dose.

Keywords: Solar cell, Gamma radiation, Photospectral current, IV characteristic, Short circuit current, Open circuit voltage

Byan Wahyu Riyandwita, Muhammad Subhan, Topan Setiadipura, Almira Citra Amelia, Sri Hastuty, Purwo Kadarno, Farisy Yogatama., *Design Scenario and Analysis for Preliminary Specification of Steam Generator in the PeLUIt-40.*, Tri Dasa Mega, 25 (1), 15.

The helical steam generator is connected to an HTGR-type nuclear reactor called PeLUIt-40 for steam production. Steam is used to generate electricity and hydrogen. A once-through helical tube bundle was employed because of its ability to endure mechanical stress due to thermal expansion, high resistance to flow-induced vibrations, and better thermal performance compared to a straight tube one. To produce the targeted steam, a design analysis of the once-through helical steam generator needs to be conducted. A quick evaluation method was used to predict the preliminary specifications required for steam production. Simple thermodynamic calculations combined with empirical heat transfer coefficients covering convective and boiling processes at constant pressure were used to carry out the analysis. Two scenarios were conducted to evaluate the design choice based on the previous design of RDE-10

Keywords: Design scenario, PeLUIt-40, HTGR, Once-through Helical Steam Generator, Surface area

Dewi Nur Riskiana, Anis Rohanda, Farzand Abdullatif, I Wayan Ngarayana., *Determining Gamma Source in Uranium Molybdenum of Fuel in G.A Siwabessy Multi-Purpose Reactor.*, Tri Dasa Mega, 25 (1), 23.

Nuclear fission reactions produce a lot of radionuclides that release energy, one of which is in the form of gamma radiation. Gamma radiation is produced by various types of radionuclides, and nuclear reactor fuel will produce different values of gamma intensity. Uranium Molybdenum (U7MO-Al) is the type of nuclear fuel for future research reactors that possesses many advantages. For the application of molybdenum-based fuel, it is necessary to determine the resulting gamma radiation. The purpose is to determine the gamma radiation produced from molybdenum-based fuel with various densities. This study begins with the determination of the mass composition of the reactor component, calculations with ORIGEN2.1, and data output analysis. The U7Mo-Al density was varied, namely 2.96 gU/cm3, 3.85 gU/cm3, 4.44 gU/cm3, 5.43 gU/cm3, 6.91 gU/cm3, and 8.29 gU/cm3. The gamma radiation yield of U7Mo-Al is lower than that of uranium silicide (U3Si2) with the same density of 2.96 gU/cm3. The result will add to the justification for the superiority of U7Mo-Al compared to U3Si2/Al. For U7Mo-Al with densities of 3.85 gU/cm3, 4.44 gU/cm3, 5.43 gU/cm3, 6.91 gU/cm3, and 8.29 gU/cm3, the one that produced the lowest gamma radiation intensity is 3.85 gU/cm3 while the highest is 8.29 gU/cm3. This explains that the intensity of the gamma radiation produced is directly proportional to the fuel density. The low intensity of gamma radiation in molybdenum-based fuel can be used as a suggestion in shielding design to ensure the operational safety of reactors.

Keywords: Intensity, Gamma source, Uranium Molybdenum, RSG-GAS, Densities,

I Wayan Ngarayana., *Synthesis and Characterization of Cesium Silicate to Determine Its Detailed Properties as Chemisorbed onto Structural Materials of Light Water Reactor During Severe Accident Conditions.*, Tri Dasa Mega, 25 (1), 33.

The cesium chemisorption phenomenon strongly contributes to the source terms transport during light water nuclear reactor accidents. Large amounts of cesium silicates are identified to be chemisorbed onto structure material, reduce cesium volatility, and affect the late release and re-vaporization phenomena. Although it has been studied for a long time, several characteristics of these compounds are still under discussion. In this study, Cs2SiO3, Cs2Si2O5, and Cs2Si4O9 were synthesized through the solid-state method and the results have been confirmed using X-Ray Diffraction (XRD) measurement. Furthermore, their crystal structures have been refined based on the XRD analysis. The crystal structure refinement of these compounds proves the previous studies, but with minor distinctions in the lattice parameters. XRD patterns changing over time when measured in the open-air environment also show that Cs2Si4O9 is the most stable species among other cesium silicate species. This indicates that the chemisorbed Cs-Si-O compound onto the structural material as identified by previous studies is most likely Cs2Si4O9 rather than Cs2SiO3 or Cs2Si2O5. Therefore, detailed Cs2Si4O9 identification including its thermodynamic properties characterization could be very useful to enhance the database that is being built to improve current source terms transport codes.

Keywords: Cesium silicates, Source terms, Chemisorption, Retention, Synthesis, Crystal structure

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