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Abstract Collection

Afifa Pramesywari, Mukhsinun Hadi Kusuma, Berkah Fajar Tamtomo Kiono, Khoiri Rozi, Haura Emara, Giarno, Yoyok Dwi Setyo Pambudi, Muhammad Mika Ramadhani Restiawan, Sumantri., *Experimental Study of The Influences of Inclination Angle and Heat Load on Loop Heat Pipe Thermal Performance*., Tri Dasa Mega, 26 (2), 51.

The utilization of nuclear power brings out a lot of benefits in fulfilling human needs for power. However, the thermal accident caused by the failure of an active cooling system due to an earthquake followed by a tsunami, such as in the Fukushima Dai-Ichi Nuclear Power Plant, Japan, could be taken as a lesson learned to keep improving the operation safety aspects of nuclear installation. Loop heat pipe (LHP), as an alternative cooling system technology, could be utilized to handle thermal problems on nuclear installations. This research aims to understand the influence of the inclination angle and heat load on the thermal performance of LHP. The experimental investigation was performed with varying inclination angles of 0°, 2.5°, and 5°, and hot water temperatures of 60°C, 70°C, 80°C, and 90°C. The LHP used demineralized water as the working fluid. The demineralized water was charged to the evaporator with a filling ratio of 100%. LHP was vacuumed on 2.666,4 Pa. Atmospheric air was used as a condenser coolant and blown with a velocity of 2.5 m/s. The result of this experiment showed that LHP has the best thermal performance with the lowest thermal resistance of 0.0043 °C/W. This result was obtained when the LHP operated with a 5° inclination angle and hot water at a temperature of 90 °C. The conclusion from this research shows that LHP thermal performance is better as the inclination angle increases on LHP because the steam velocity formed is bigger, and condensate flows back to the evaporator faster.

Keywords: Inclination angle, Heat load, Thermal works performance, Loop heat pipe, Passive cooling system, Nuclear installation

Alif Rahman Wirza, Mukhsinun Hadi Kusuma, Khoiri Rozi, Berkah Fajar Tamtomo Kiono, Muhammad Mika Ramadhani Restiawan, Giarno, Yoyok Dwi Setyo Pambudi, Muhammad Yunus, Sofia Loren Butarbutar, Sumantri Hatmoko, Nanang Apriandi, Afifa Pramesywari., Experimental Investigation of Natural Circulation Stability Phenomena in a New Loop Heat Pipe Model., Tri Dasa Mega, 26 (2), 61.

The severe accident at the Fukushima Dai-ichi Nuclear Power Plant in Japan in 2011 highlighted the critical need for a passive cooling system to dissipate residual decay heat following the failure of active cooling systems in the nuclear facility. The loop heat pipe (LHP) is a promising technology for such applications. The objective of this research is to understand the natural Alif Rahman Wirza, Mukhsinun Hadi Kusuma, Khoiri Rozi, Berkah Fajar Tamtomo Kiono, Muhammad Mika Ramadhani Restiawan, Giarno, Yoyok Dwi Setyo Pambudi, Muhammad Yunus, Sofia Loren Butarbutar, Sumantri Hatmoko, Nanang Apriandi, Afifa Pramesywari., Experimental Investigation of Natural Circulation Stability Phenomena in a New Loop Heat Pipe Model., Tri Dasa Mega, 26 (2), 69. circulation stability phenomena of the new LHP model under various conditions of filling ratio and heat load. The experimental methodology employed a laboratory-scale LHP model made of copper with an inner diameter of 0.104 m. The experiments were designed with filling ratios of 20%, 40%, 60%, 80%, and 100%, and hot water temperature as the evaporator heat source with variations of 60 °C, 70 °C, 80 °C, and 90 °C. The initial operating pressure was 10665.6 Pa, with a 5˚ inclination angle, demineralized water as the working fluid, and cooled by air at a velocity of 2.5 m/s. The results show that LHP natural circulation happens in two phases and stays stable. The best performance was seen at 90 °C and an 80% filling ratio. The conclusion of this research indicates that natural circulation stability in LHP operates well and occurs in two phases. This demonstrates that LHP effectively acts as a heat absorber and heat dissipator.

Keywords: Filling ratio, Natural circulation stability, LHP, Passive cooling system.

Muhammad Mika Ramadhani Restiawan, Mukhsinun Hadi Kusuma, Khoiri Rozi, Berkah Fajar Tamtomo Kiono, Muhammad Yunus, Alif Rahman Wirza, Yoyok Dwi Setyo Pambudi, Sofia Loren ButarButar, Giarno, Sumantri Hatmoko., *Computational Fluid Dynamics Simulation of Temperature Distribution and Flow*

Characterization in a New Loop Heat Pipe Model., Tri Dasa Mega, 26 (2), 69.

The loop heat pipe (LHP) is being considered for passive cooling systems in nuclear installations. A combined approach of simulation and experimentation is essential for achieving comprehensive knowledge of the LHP. Research on the LHP using Computational Fluid Dynamics (CFD) is necessary to understand phenomena that are challenging to ascertain experimentally. This study examines the temperature distribution and flow characteristics in a new LHP model. The method used in this research is simulation using CFD Ansys FLUENT software. In the simulation, the LHP has an inner diameter of 0.1016 m. This LHP features a wick made from a collection of capillary pipes without a compensation chamber. Demineralized water is used as the working fluid with a filling ratio of 100% of the evaporator volume. The hot water temperature in the evaporator section is set at 70 °C, 80 °C, and 90 °C. The temperature on the outer surface of the condenser pipe is determined using experimental temperature inputs. An inclination angle of 5° and an initial pressure of 12,100 Pa are applied to LHP. The CFD simulation results show that the temperature distribution profile under steady-state conditions in the loop heat pipe appears almost uniform. The temperature difference between the evaporator and condenser remains consistent. The flow of working fluid in the LHP is driven by buoyancy forces and fluid flow, allowing the working fluid in the LHP to flow in two phases from the evaporator to the condenser and then condensate from the condenser back to the evaporator. In conclusion, the temperature distribution and flow patterns in the LHP are consistent with common phenomena observed in heat pipes. This modeling can be used to determine the profiles of temperature distribution and flow in LHP of the same dimensions under various thermal conditions.

Keywords: Temperature distribution, Flow characterization, Computational fluid dynamic, Loop heat pipe, Passive cooling system.

Iwan Roswandi, Dimas, Hyundianto Arif Gunawan, Arif Adtyas Budiman, Almira Citra Amelia, Sanda, Hendro Tjahjono, Mulya Juarsa., *Investigation of Natural Circulation Flow Under Steady-State Conditions Using a Rectangular Loop*., Tri Dasa Mega, 26 (2), 77.

Passive safety systems, particularly during active system failures, have become a significant concern. Understanding natural circulation phenomena is crucial for developing passive cooling systems in nuclear power plants. With its significant findings, this study examines the flow patterns under steady-state conditions and assesses the Grashof number. The experimental approach involved maintaining temperature differences of 60 °C, 70 °C, 80 °C, and 90 °C for 3 hours, with three replications. The temperature alterations impact water's physical properties, such as density, viscosity, and specific heat. The calculations reveal that the minimum Grashof number that occurs at 60 °C is 2.49×10^{12}, while the maximum observed at 90 °C is 9.42×10^{12}, with an R2 value of 0.96533. The observation of turbulent flow patterns during each temperature fluctuation, which aligns with previous research on the Ress value of Grm/NG, has significant implications for the design and operation of passive safety systems in nuclear power plants

Keywords: NPP, Grashof Number, FASSIP-05, NCL, Passive Cooling.

Santo Paulus Rajagukguk, Purwadi Purwadi, Syaiful Bakhri., *Analysis of the Reactivity Coefficient of the PWR Thorium Fuel*., Tri Dasa Mega, 26 (2), 87.

In design, control, and safety, especially in Pressurized Water Reactors, the Reactivity Coefficient parameter is crucial. The validation of every new library for an accurate parameter prediction is then crucial. The purpose of this work is to determine the value of the reactivity coefficient at the Beginning of the Cycle (BOC) and End of the Cycle (EOC) using the WIMSD code based on ENDF/B-VIII.0 nuclear data files. The PWR-1175 MWe experiment critical reactors, which use Th-UO2 fuel pellets, are a set of light water-moderated lattice experiments that were used for this purpose. The study applied the new cross-section libraries for WIMSD-5B with ENDF/B-VIII.0 lattice code. The results showed that the fuel temperature reactivity coefficients for the PWR reactor at BOC and EOC using new libraries are –4.07 pcm/K and –2.72 pcm/K, respectively. Moderator Temperature Reactivity Coefficient at BOC and EOC are -1.8E-03 pcm/K and 3.73 pcm/K, respectively. Compared to the experimental data of the reactor core, the difference is in the range of 5.0 %. It can be concluded that for the PWR using thorium fuel as a model, all reactivity coefficients are negative and it is a good design for the safety of operation.

Keywords: Reactivity coefficient, PWR reactor, Moderator, Thorium Fuel, WIMSD-5B.

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