Contribution ID: **59** Type: **not specified**

Importance and issues of CaH_2 TLS data for reactivity coefficient and core characteristics of MoveluX^{TM} /超小型炉 MoveluX^{TM} における CaH_2 の温度反応度特性と炉心特性における熱中性子散乱則データの重要性と課題

Thursday, 14 November 2024 14:20 (30 minutes)

To realize a decarbonized society, various organizations are developing small modular reactors and micro-reactors [1]. Toshiba Energy Systems & Solutions has been developing a MoveluX^{TM} reactor system with 10 MWt and 3-4 MWe power output. The MoveluX^{TM} core uses less than 5% LEU as the nuclear fuel. Furthermore, calcium hydride (CaH_2) is also used as the solid-state neutron moderator. The hydrogen in CaH_2 dissociated above 800 °C; thus, this temperature is the operation limitation temperature of the core. From the viewpoint of the core characteristics, the CaH_2 moderator shows a positive temperature reactivity coefficient from room temperature to near the operation temperature [2].

The MoveluX^{TM} core utilizes this positive temperature reactivity coefficient to assure critical safety during transport [3]. To evaluate this core characteristic, the TSL of CaH_2 is very important input data for the core calculation. However, only JEFF published TSL data on the CaH_2, and it was based on one experiment's data.

On the other hand, the Toshiba Energy Systems & Solutions Corporation measured TSL of CaH_2 in the past research with Tokyo Tech and Kyoto University. Additionally, JAEA also evaluates this TSL based on the simulation. The MoveluX^{TM} core had around 200 pcm between these TLS data, furthermore, more than a 2% difference in temperature reactivity coefficient was confirmed. These differences were not small, thus, improvement of the CaH_2 TSL data will be required.

References

[1] J. Buongiorno, et al, "The Future of Nuclear Energy in a Carbon-Constrained World", Massachusetts Institute of Technology, MA, USA, (2018) p. 26.
[2] R. Kimura, S. Wada, "Temperature Reactivity Control of Calcium–Hydride–Moderated Small Reactor Core with Poison Nuclides", Nucl. Sci. Eng., 193 (9), (2019) pp.1013-1022.
[3] R. Kimura, K. Asano, "Ensuring Criticality Safety of vSMR Core During Transport Based on Its Temperature Reactivity", Nucl. Sci. Eng.,194 (3), (2020), pp.213-220.

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Session Classification: Current Status and Issues of the Thermal Neutron Scattering Law /熱中性子散乱則データの現状と課題