

Importance and issues of CaH₂ TLS data for reactivity coefficient and core characteristics of MoveluXTM /超小型炉 MoveluXTM における CaH₂ 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 MoveluXTM reactor system with 10 MWt and 3-4 MWe power output. The MoveluXTM core uses less than 5% LEU as the nuclear fuel. Furthermore, calcium hydride (CaH₂) is also used as the solid-state neutron moderator. The hydrogen in CaH₂ dissociated above 800 °C; thus, this temperature is the operation limitation temperature of the core. From the viewpoint of the core characteristics, the CaH₂ moderator shows a positive temperature reactivity coefficient from room temperature to near the operation temperature [2].

The MoveluXTM core utilizes this positive temperature reactivity coefficient to assure critical safety during transport [3]. To evaluate this core characteristic, the TSL of CaH₂ is very important input data for the core calculation. However, only JEFF published TSL data on the CaH₂, and it was based on one experiment's data.

On the other hand, the Toshiba Energy Systems & Solutions Corporation measured TSL of CaH₂ in the past research with Tokyo Tech and Kyoto University. Additionally, JAEA also evaluates this TSL based on the simulation. The MoveluXTM 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 CaH₂ 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.

Primary author: KIMURA/木村, Rei/礼 (Toshiba Energy Systems & Solutions Corporation/東芝エネルギーシステムズ株式会社)

Presenter: KIMURA/木村, Rei/礼 (Toshiba Energy Systems & Solutions Corporation/東芝エネルギーシステムズ株式会社)

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