SLEEVELESS FUEL COMPACT SUPPORT: SPACER DESIGN AND FLOW-INDUCED VIBRATION ANALYSIS IN HTGR

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The design of sleeveless fuel compacts offers significant potential to improve heat removal efficiency in high temperature gas-cooled reactors (HTGRs) by enabling dual-separate direct cooling in helium flow. In the reactor core, fuel spacers play a critical role in supporting sleeveless fuel compacts and maintaining open flow channels, thus ensuring structural integrity. However, designing fuel spacers is a major challenge, as it must stabilize all fuel components while minimizing vibration, mechanical wear, and mechanical or thermal stress during normal operation. To address this challenge, this study introduces four types of spacer designs with varied structures and configurations, including ring-type and helical wire-wrapped spacers. Real-scale prototypes were produced using a 3D printer. To investigate flow-induced vibration between the fuel compacts and spacers, the horizontal displacement of components was measured in an inert gas flow using a high-precision laser displacement sensor. Additionally, the pressure drop at the inlet and outlet was measured to characterize gas flow around the fuel components. The study demonstrates that each spacer design effectively supports the fuel components and maintains the flow channels. Preliminary tests indicate that flow-induced vibration impacts were within acceptable limits, suggesting structural stability across the different spacer designs.

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