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Performance Analysis of Nuclear Thermal Propulsion Reactor Using Driver Fuel Element

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Abstract. A nuclear thermal propulsion (NTP) reactor concept based on the expansion cycle using CERMET driver fuel element was proposed and analyzed for physical and thermal properties. This NTP concept has a thrust of 110 kN and a specific impulse of approximately 900 s. The analysis results showed that, this NTP reactor concept satisfied basic reactor physics and thermal design criteria and it is a reasonable theme. By changing the fuel enrichment, 30 drive fuel elements, symmetrically arranged at the edge of the core active zone, can provide 35-70 MW of heat, thereby achieving a hydrogen temperature rise of 200-400 K (sufficient to drive the hydrogen turbine pump), as the pressure drop is less than 2 MPa. The concept of a nuclear thermal propulsion reactor using a driver fuel element is reasonable.Compared with the NTP reactor concept based on the hot bleed cycle without the driver fuel element, the NTP reactor concept using the driver fuel element can achieve more efficient use of the propellant, and the specific impulse is increased by more than 20s.

Keywords: Nuclear Thermal Propulsion (NTP), Driver Fuel Elemnet, Ceramic Metal (CERMET) Fuel