

Modeling Reactor Fuel Performance for Nuclear Thermal Propulsion

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Nuclear thermal propulsion (NTP) is an excellent option for manned space travel to Mars because it provides constant thrust for long periods of time. In NTP, liquid hydrogen is rapidly heated by a nuclear reactor and then expelled from a nozzle to provide thrust. The fuel for NTP has historically been a CerMet fuel (a ceramic fuel embedded in a metallic matrix), typically composed of a UO_2 fuel and a W matrix. While these fuels have been under development for many years, there are still many performance issues that need to be addressed, including fuel loss due to interactions with the high velocity hydrogen. In this presentation, we are demonstrating how we are using the MARMOT mesoscale nuclear materials code to determine the properties of the CerMet fuel, which are then used in macroscale simulations of the fuel performance using the BISON fuel performance code. We also show how we are beginning to model the fuel loss using MARMOT, to eventually determine how best to inhibit it.