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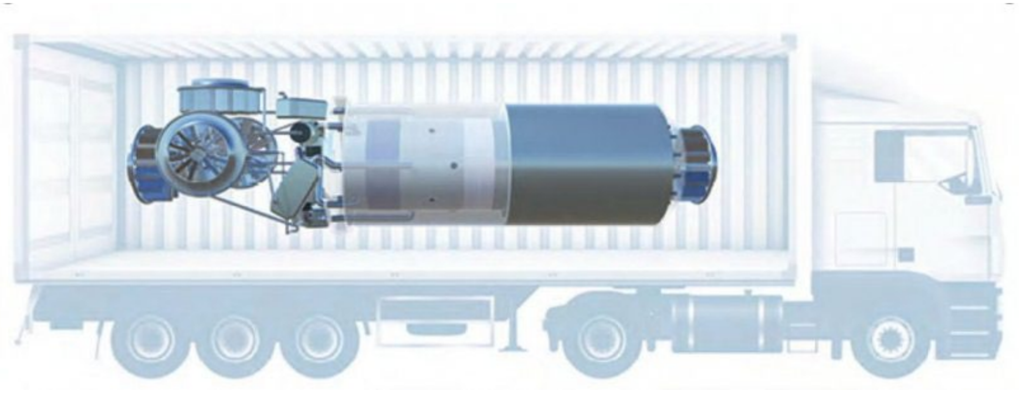
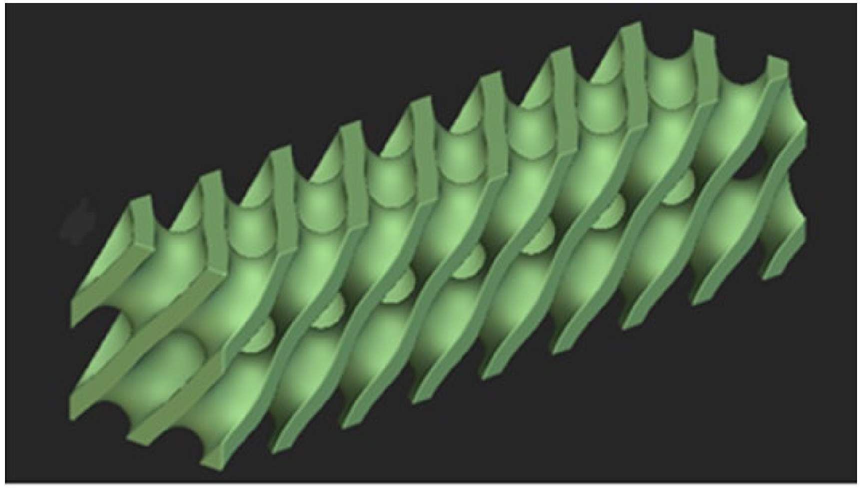
Project: Intertwined Nuclear Fuel Lattice for Upgraded Heat Exchanger (INFLUX)
Advisor(s): Mark Anderson
Sponsor: Idaho National Laboratory

Background

- Compact nuclear microreactors are a promising form of carbon-free energy
  - Transportable
  - Factory fabricated
- Heat exchangers based on triply periodic minimal surface (TPMS) lattices provide a compact, self-supporting intertwined surface with high surface area
- Additively manufacturing nuclear fuel within a TPMS lattice would act as the powerful, compact core for nuclear microreactors



Nuclear micro-reactor illustration (Source: Department of Energy)



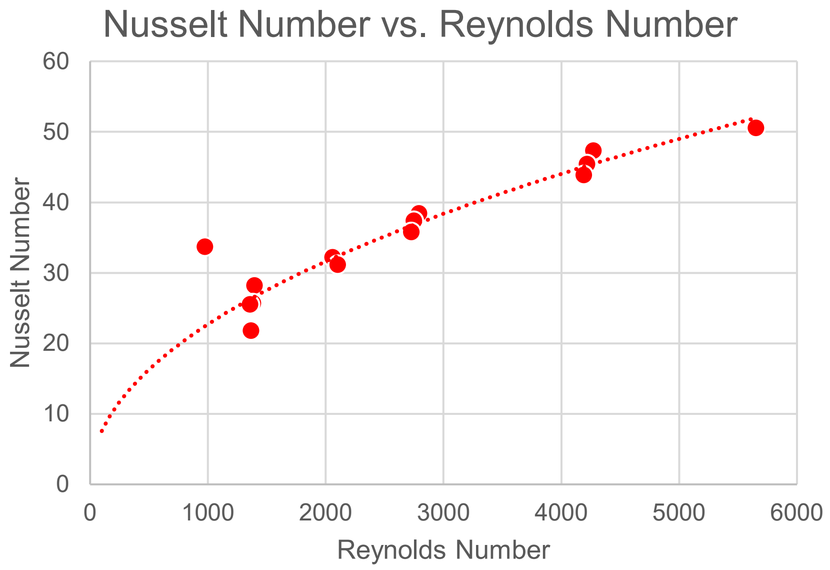
TPMS Lattice generated in nTopology

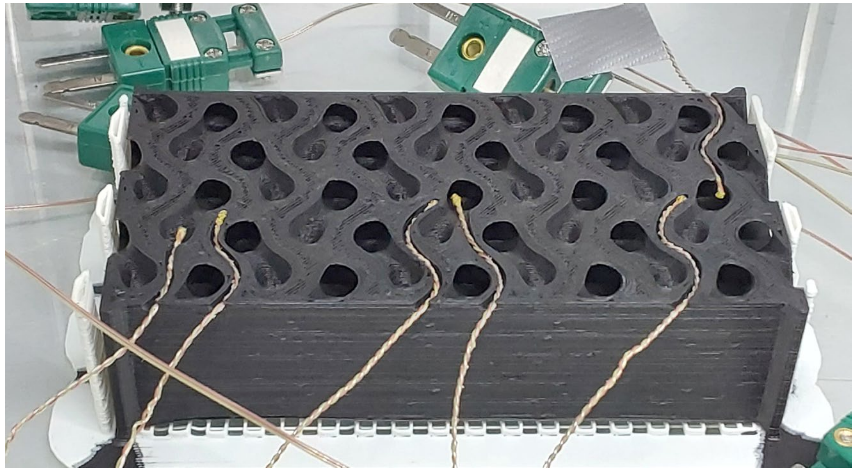
Project Goals

- Demonstrate volumetric heat generation within a TPMS lattice using conductive PLA to serve as a parallel for a nuclear fuel

- Explore the hydraulic and thermal characteristics of various types and sizes of TPMS structures
  - Pressure drop
  - Heat transfer coefficient

- Use experimental data to develop a reduced-order (porous media) model for heat transfer





Additively manufactured TPMS test specimen with embedded thermocouples