Thermosyphon Irradiation Facility

In research reactors, such as the High Flux Isotope Reactor (HFIR), fuel testing is often limited by the reactor's safety basis requirements. For example, experimental claddings must be housed inside an outer containment to ensure that cladding failures will not contaminate the reactor coolant. This added component requires an extra gas gap which artificially increases temperatures and reduces acceptable heat loads. The Thermosyphon Irradiation Facility has the potential to reduce or eliminate some of these limitations by providing hydraulic isolation in a high heat transfer environment, allowing for higher heat loads, lower temperatures, better temperature control, and improved safety margin. The Thermosyphon Test Loop has been constructed to verify the operating characteristics of the facility.

Condenser Section of the Thermosyphon Test Loop

Features

- Allows accelerated fuel/clad irradiation testing under prototypic LWR conditions
- Offers near isothermal operating conditions.
- Working temperature can be controlled by sizing the condenser such that the saturation temperature equals the working temperature.
- Reliance on very small gas gaps in experiment designs to control temperature is eliminated so that machining tolerances and irradiation swelling are relatively insignificant.
- Larger experiment heat loads are allowable because the heat is transferred to HFIR coolant through the much larger heat transfer area of the condenser.
- The entire assembly is in a sealed containment with no moving parts, ensuring very high reliability.
- Fuels and materials can be irradiated in a high-heat-transfer secondary coolant without potentially contaminating HFIR primary coolant.

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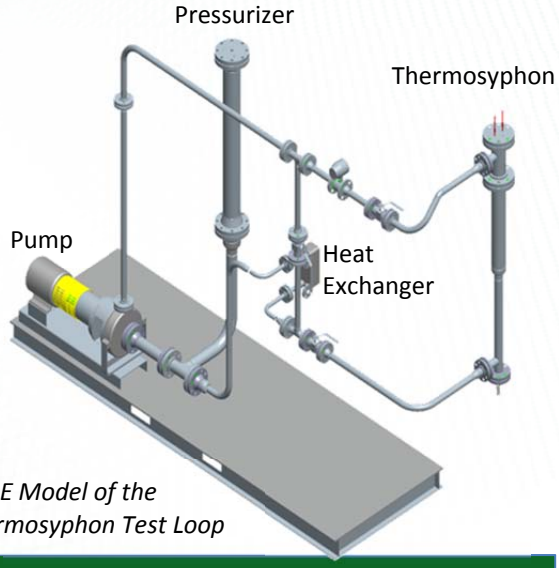
Thermosyphon Test Loop Operating Envelope	
Maximum Operating Pressure	15.5 MPa
Maximum Operating Temperature	347°C
Nominal Heater Temperature	320°C
Maximum Heater Linear Power	52.5 kW/m
Maximum Heater Heat Flux	176 W/cm^2
Nominal Heater Diameter	9.53 mm



Pro-E Model of the Thermosyphon Test Loop

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