



MAGNET
Environmental
Enclosure

Microreactor AGile Non-Nuclear Experimental Test Bed (MAGNET)

Integrated Thermal Testing Capability to Enable Microreactors

The U.S. Department of Energy (DOE) Microreactor Program supports research and development (R&D) of technologies related to development, demonstration and deployment of very small, factory-fabricated, transportable reactors to provide power and heat for decentralized generation in civilian, industrial and defense energy sectors.

Led by Idaho National Laboratory, the program conducts fundamental and applied R&D to reduce the risks associated with new technology performance and manufacturing readiness of microreactors. The intent is to ensure that microreactor concepts can be developed, licensed and deployed

by commercial entities to meet specific uses.

The program coordinates work across participating laboratories, universities and industry as well as other DOE programs. Participants include Argonne National Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory, Pacific Northwest National Laboratory and Sandia National Laboratories.

WHAT IS THE MICROREACTOR AGILE NON-NUCLEAR EXPERIMENTAL TEST BED?

The DOE Microreactor Program's Microreactor AGile Non-nuclear Experimental Test Bed (MAGNET) uses electrical resistance heaters to emulate core thermal behavior and provide input

for primary heat exchanger performance for heat pipe and gas-cooled microreactors.

Through collaboration between participating national laboratories, MAGNET supports verification and validation of detailed microreactor thermal hydraulic models for startup, shutdown, steady-state, and off-normal transient behavior. Researchers can perform non-nuclear testing in MAGNET prior to a nuclear system demonstration. MAGNET is available for experimental use by national laboratory, university and industry partners.

MAGNET will ultimately be integrated into the broader INL Systems Integration Laboratory, which includes thermal and electrical energy users such as steam



MAGNET will

Provide a facility for researchers and technology developers to test microreactor concepts in a relevant environment to advance technical maturity.

FOR MORE INFORMATION

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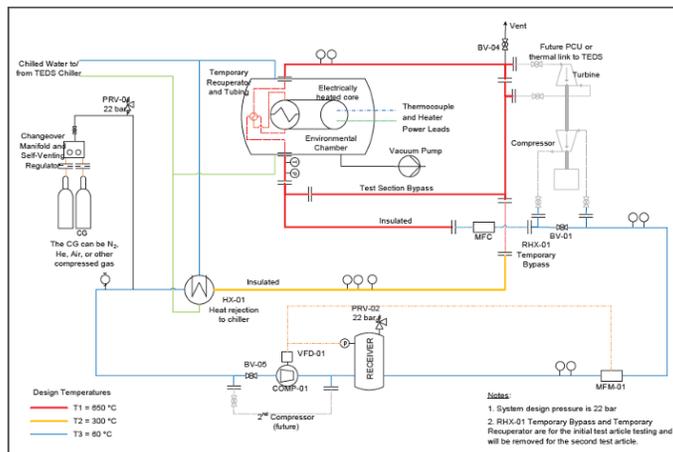
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MAGNET Process Flow Diagram

electrolysis, real-time digital simulators for power systems emulation, a microgrid test bed, a thermal energy distribution system and renewable energy generation.

HOW WILL MAGNET BE USED TO SUPPORT MICROREACTOR DEVELOPMENT?

MAGNET can be broadly used to assess microreactor structures, systems and components, advancing technical readiness of microreactors for broader use. The following examples support microreactor development and use by assessing:

- **Heat transfer within microreactor components**, including core structures, heat exchanger components, and alternative heat removal approaches.
- **Structural performance of core structures**, including thermal stress, strain, aging/fatigue, creep, and deformation.
- **Evaluating heat pipe performance and integration** for transferring heat from core structures to heat exchangers for

heat pipe functionality and heat transfer capabilities.

- **Investigating high-performance integral heat exchangers** for high-efficiency heat transfer from core structures to power cycle working fluids.
- **Testing components produced by advanced manufacturing**, including heat exchangers, core components and other structures.
- **Testing advanced sensors, instrumentation and control** through instrumented test articles and control systems.
- **Cyclic load testing** to better understand material and component behaviors for transient (thermal cycling) and load following operations.
- **Validating modeling and simulation tools** through experiments and direct engagement with computational model and tool developers.

WHAT ARE THE DESIGN SPECIFICATIONS FOR MAGNET?

Electrically Heated Core

- Up to 250 kW electrical power to core heaters.

- Maximum test article temperature of 750 C.

Environmental Chamber

- Vacuum or inert gas at atmospheric pressure.
- 5 ft × 5 ft × 10 ft with test article support platform on rails.
- Water-cooled chamber walls.
- Flanges for gas flow connections, instrumentation feedthroughs ports, and viewing windows.

Gas Coolant Flow Loop

- Designed to operate with air, nitrogen or helium.
- Up to 250 kW heat removal from test article.
- Design pressure 22 barg.
- Design temperature 650 C in hot section.
- Gas flow rates up to 39.6 ACFM at 290 psig (initial single-compressor configuration).
 - Nitrogen mass-flow rates up to 0.5 kg/s.
 - Helium mass-flow rates up to 0.07 kg/s.
 - Coriolis effect mass flow meter.
 - Compressor speed control via variable-frequency drive.
- Flexible configuration for future incorporation of a power conversion unit.
- 350 kW recuperator
- 265 kW chilled-water-cooled gas cooler.

Battelle Energy Alliance manages INL for the U.S. Department of Energy's Office of Nuclear Energy. INL is the nation's center for nuclear energy research and development, and also performs research in each of DOE's strategic goal areas: energy, national security, science and the environment. For more information, visit www.inl.gov.