

Kairos Power
partnered with
Argonne National Laboratory

NE-22.28066: Deployment of Advanced Electroanalytical Sensors in the Kairos Power Engineering Test Unit (ETU)

YEAR AWARDED: 2022

TOTAL PROJECT VALUE: \$400,000 (DOE: \$320,000, Kairos: \$80,000)

STATUS: Completed

PRINCIPAL LAB INVESTIGATORS: Nathaniel Hoyt (ANL, Francesco Carotti (Kairos)

DESCRIPTION: Kairos Power is a nuclear energy technology and engineering company based in Alameda, Calif. This project, in collaboration with Argonne National Laboratory (ANL), involved chemistry monitoring and control systems for the molten salt that is used as a coolant for Kairos' reactor design. Kairos Power sought to optimize electroanalytical sensors developed at ANL to enable stable measurements of industrial-scale FLiBe, a mixture of lithium and beryllium fluoride salts. Tests were done in the Kairos Power Engineering Test Unit (ETU) in Albuquerque, N.M., a non-nuclear full-scale prototype of its Hermes reactor, a 35 megawatt-thermal high-temperature fluoride salt-cooled reactor (FHR) the company is planning to build at Oak Ridge, Tenn., under the Advanced Reactor Demonstration Program.

BENEFIT: The project provided a direct benefit to the development of Kairos Power's Hermes reactor by yielding key insights into the long-term operations of the company's molten salt equipment.

IMPACT: Argonne deployed its ILEX Automation© software for electrochemical system automation, which facilitated thousands of semi-autonomous, in-situ measurements. It additionally provided electrochemical measurement protocols and assisted with data interpretation.

SIGNIFICANT CONCLUSIONS: First-of-a-kind online measurements regarding the FLiBe salt chemistry during all phases of ETU salt operations were obtained. Argonne successfully engineered and tested a novel electrochemical multiplexer system that could remotely control two sensors distributed across the facility and could accommodate the high currents necessary for Kairos Power's engineering scale system.

NEXT STEPS: Kairos Power completed 2,000+ hours of pumped salt operations with ETU 1.0 in early 2024 at its Albuquerque, N.M., testing and manufacturing facility. It plans to build a second ETU in the same location and a third in Oak Ridge to lay the groundwork for Hermes operations starting in 2026. Kairos Power's first commercial fluoride salt-cooled high-temperature Reactor (KP-FHR) is expected to be operational by the early 2030s.