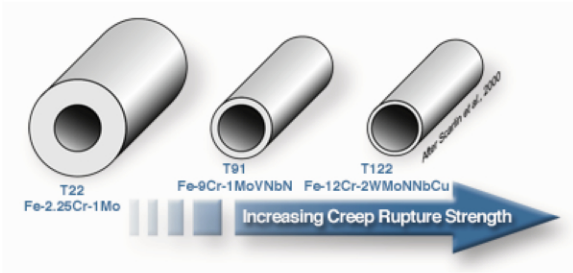
EES
Energy and Engineering Sciences

Fossil Energy Program

The Oak Ridge National Laboratory Fossil Energy Program provides innovative solutions to the Department of Energy Office of Fossil Energy for coal, oil, and gas technology. Major activities are directed toward exploration and production issues associated with these primary energy sources, as well as the development of gas separation systems (inorganic membranes and adsorbent carbons) that are critical enabling technologies and materials that are critical supporting technologies for advanced power systems being developed by DOE Fossil Energy.

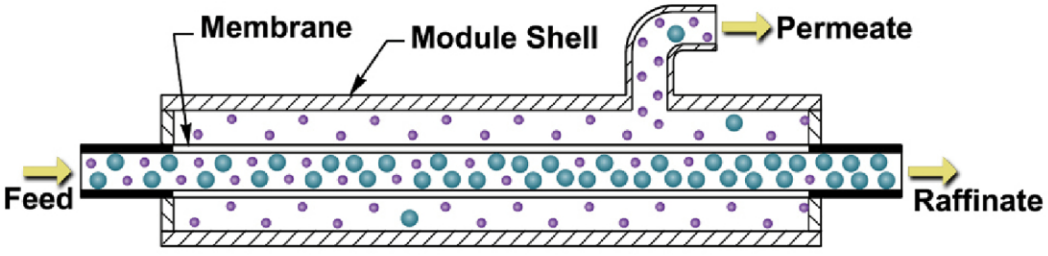
Materials for Ultra-Supercritical Steam Power Plant

In an integrated power supply system, all fossil-fuel power plants will be required to load-cycle. ORNL is developing alloys with adequate strength to allow the use of tube walls thin enough to minimize the thermal fatigue problem. The criterion for creep strength is 100 MPa for 105 hours at service temperature.



Fuel Cells and Functional Materials

The United States is committed to a future hydrogen economy. Coal is a potential source for the hydrogen fuel that will be needed. Coal gasification offers one of the most versatile and cleanest ways to convert the energy content of coal into hydrogen. ORNL is developing a hydrogen separation membrane for use in coal gasification processes.

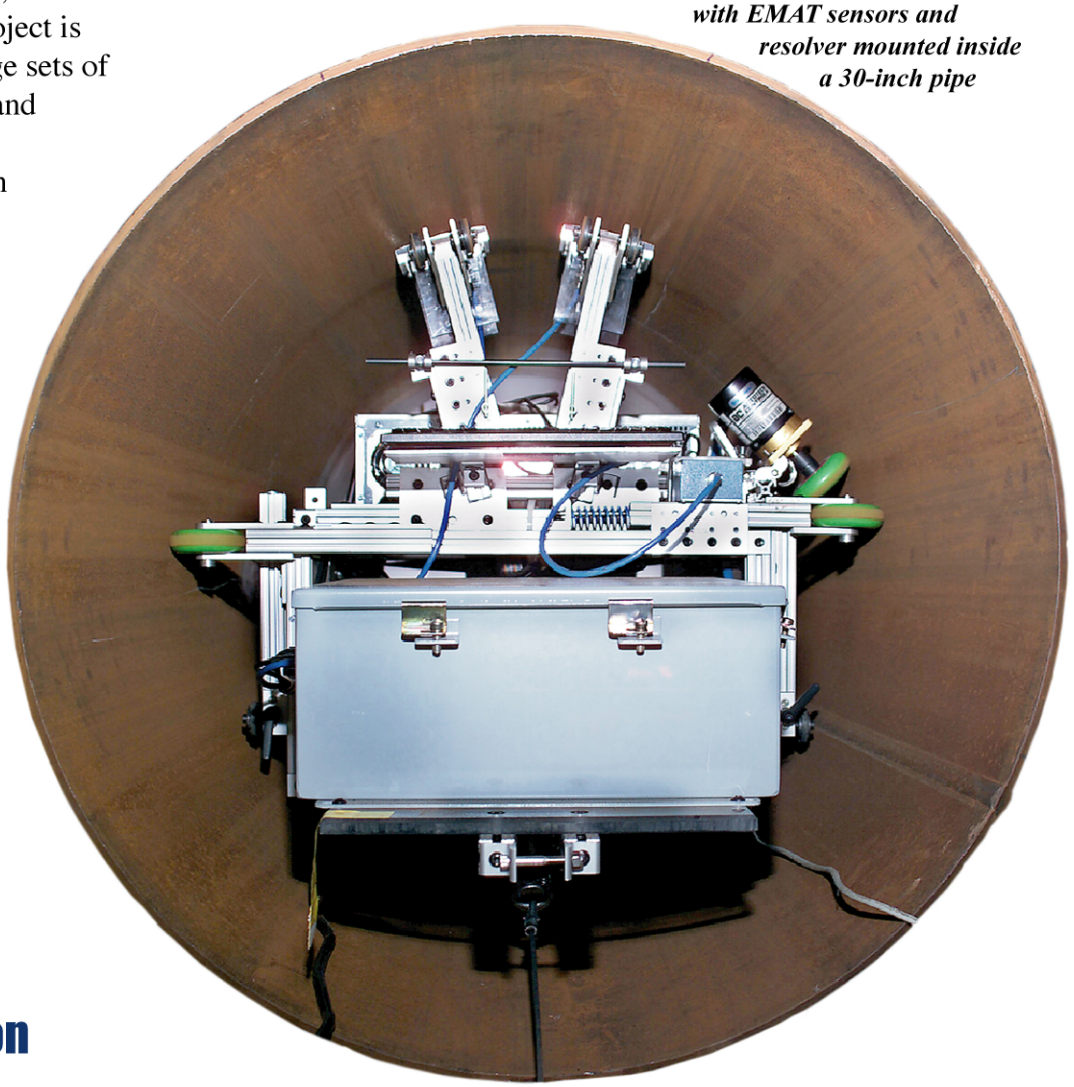


Separation module using molecular sieve membrane to separate gases

OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

Oil and Gas Research

ORNL is developing sensors for use in the oil and gas industry. Pipe inspection gear based on a noncontact ultrasonic sensor (EMAT) is being developed for in-line inspection of flaws in a 30-inch natural gas line. The sensor is capable of detecting physical flaws, circumferential and axial flaws, and corrosion in walls of gas pipelines. Currently the project is concentrating on obtaining large sets of EMAT signals from defective and good sectors of pipes and developing a wavelet algorithm to identify the defects.



ORNL pipe inspection gear with EMAT sensors and resolver mounted inside a 30-inch pipe

Natural Gas and Carbon Sequestration

ORNL is demonstrating that iron-reducing bacteria can convert CO_2 into sparingly soluble carbonate minerals, such as calcite and siderite, using metal-containing fly ash and lime. These bacteria may complement the capture of CO_2 from fossil fuel plants while stabilizing fly ash wastes and binding the fly ash into solid materials. This research may result in a technique to reduce CO_2 emissions in the atmosphere by immobilizing CO_2 to stable carbonate mineral phases, and it could turn waste ash into a useful product. We envision that the process could be combined with a waste treatment strategy in which the carbonate-forming microbes would use waste products from agriculture or food processing to supply energy for microbial growth. This would constitute energy plexing by combining multiple diverse waste streams into new product streams.

Contact:

Roddie Judkins
phone: (865) 574-4572
email: judkinsrr@ornl.gov

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