

CHEMICALS

Project Fact Sheet



A ZERO-EMISSION MECHANICAL SEAL WITH INTEGRAL MICRO HEAT EXCHANGER

ENHANCED HEAT EXCHANGERS FOR PROCESS SEALS RESULT IN ENERGY SAVINGS, REDUCED LEAKAGE AND INCREASED PRODUCTIVITY

Benefits

- Offers savings of 1.0 trillion Btu by 2010
- Offers production savings of 29.0 million Btu/yr/unit
- Offers steam turbine savings of 1.9 million Btu/yr/unit
- Decreases harmful environmental effects due to seal leakage
- Increases seal life and reduces downtime thus increasing productivity

Applications

The initial target industry is the chemical and petroleum processing industry where many toxic and organic compounds are produced. Mechanical seals are used in a variety of machines including food processing pumps, pharmaceutical pumps, as well as chemical and petroleum processing pumps.

Project Partners

NICE³ Program
Washington, DC

Louisiana Dept. of Natural Resources
Baton Rouge, LA

Louisiana State University
Baton Rouge, LA

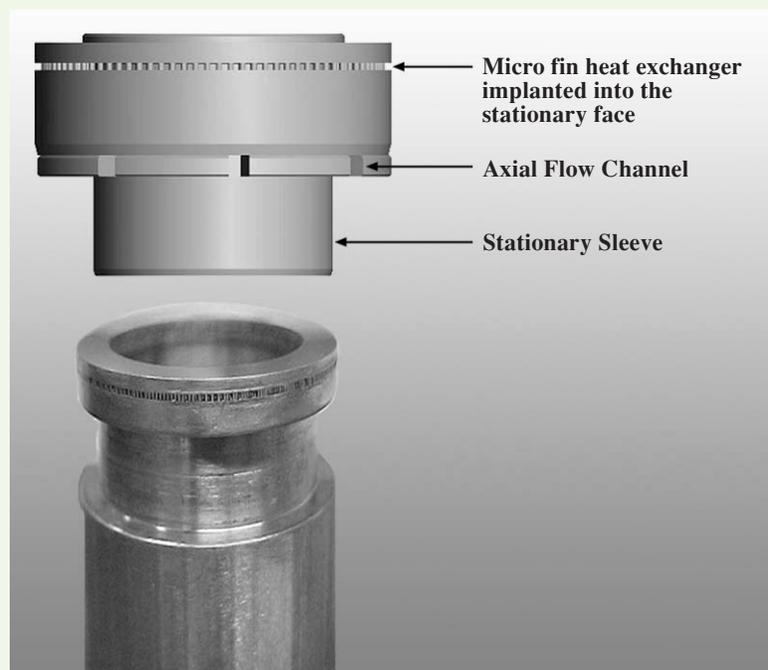
ExxonMobil Chemical Co
Baton Rouge, LA

University of Kentucky
Lexington, KY

This technology is a zero emissions mechanical seal for use in petroleum and chemical processing pumps. This design takes advantage of a micro-heat exchanger constructed using large fields of high-aspect-ratio microstructures (HARMs). These structures are implanted below the surface of the stationary ring augmented with a heat resistant coating on the surface. The surface temperature can be controlled with concomitant reduction of surface wear to the extent that seals can run dry, qualifying for zero emission.

This technology will reduce downtime, increase seal life and decrease harmful environmental effects that arise due to seal leakage. By reducing the friction between the seal surfaces, and by reducing the energy required in the manufacturing process, the design will decrease power loss and result in energy savings.

A NOVEL MECHANICAL SEAL



Schematic of a seal with implanted micro-heat exchanger (*top*) with a stationary ring prototype showing micro-post structure (*bottom*).



Project Description

Goal: To demonstrate the reliability and performance of the mechanical seal at a major end-user facility (ExxonMobil). This industrial application with a light hydrocarbon as the process (sealed) fluid will be ideal to demonstrate: (1) heat tolerance; (2) long term reliability; (3) energy impact; (4) environmental impact and (5) economic impact.

Progress and Milestones

The following are the main tasks to be performed:

- Specify and design components including coolant supply and stationary/rotating ring and glandplate design.
- Design and specify instruments and the data acquisition system including specifying the sensor required to monitor the seal during the demonstration.
- Fabricate and purchase components including fabricating the stationary mechanical seal ring with integral micro heat exchanger and mechanical components and purchasing sensor valves and piping.
- Install the mechanical seal into the pump and test the unit in commercial use for two years.

Economics and Commercial Potential

Catastrophic failure of bearings and seals costs significantly in terms of production and revenue. The industry average cost for repair of each pump is \$2500. The potential of the total economic benefit could be between \$6 million and \$12.2 million per year in the U.S. alone. Commercial introduction of the technology is expected by 2005. Annual energy savings by 2010 would be 1.0 trillion Btu. By 2020 the savings would grow to 9.9 trillion Btu.



NICE³ – National Industrial Competitiveness through Energy, Environment, and Economics: An innovative, cost-sharing program to promote energy efficiency, clean production, and economic competitiveness in industry. This grant program provides funding to state and industry partnerships for projects that demonstrate advances in energy efficiency and clean production technologies. Awardees receive a one-time grant of up to \$525,000. Grants fund up to 50% of total project cost for up to 3 years.

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