the ENERGY lab

PROJECT FACTS

Advanced Turbines

Phase III Xlerator Program: Rapid Commercialization of Advanced Turbine Blades for IGCC Power Plants—Mikro Systems

Background

Mikro Systems is developing their proprietary TOMO℠ manufacturing technology to produce turbine blades with significantly improved internal cooling geometries that are beyond current manufacturing state-of-the-art, thus enabling higher operating temperatures. Funding from the American Recovery and Reinvestment Act (ARRA) under the Small Business Innovation Research (SBIR) Phase III Xlerator Program will be directed towards accelerating commercial adoption of TOMO℠ technology by leading turbine manufacturers through the demonstration of superior manufacturability, cost, and performance. Ultimately, this technology will lead to improved efficiency and cost of gas turbines for coal-based integrated gasification combined cycle (IGCC) and natural gas combined cycle (NGCC) power applications.

This project is managed by the U.S. Department of Energy's (DOE) National Energy Technology Laboratory (NETL). NETL is researching next generation turbine technology with the goal of producing reliable, affordable, and environmentally friendly energy supplies in response to the nation's increasing energy challenges. With the Advanced Turbine Program, NETL is leading the research, development, and demonstration of these technologies to achieve power production from coal that is clean, efficient, and cost-effective, minimizes carbon dioxide (CO_2) emissions, and will help maintain the nation's leadership in the export of gas turbine equipment.

Project Description

Mikro Systems has developed a unique ceramic core casting technology — TOMO℠ — that uses precision, three-dimensional, lithographically-derived tooling that permits the intricate design and casting of enhanced heat transfer features for gas turbine blades. The Mikro Systems approach allows new internal cooling features that are not possible with current casting processes. It is envisioned that this replacement core casting technology will seamlessly integrate with established casting processes used by the industry, minimizing new capital investment requirements and quickly revolutionizing the industry's ability to enhance both existing and future turbines with new blade designs.

This project addresses the need for rapid, cost effective manufacturing of advanced turbine blades that will improve the performance of and reduce the cost of electricity produced by IGCC power plants. Mikro Systems will scale up the TOMO℠ process and produce casting cores for a row one blade in a commercial Siemens (SGT5-501F)

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PARTNERS

Siemens Energy
Precision Castparts Corp.

PERFORMANCE PERIOD

Start Date
10/01/2010

End Date
09/30/2012

COST

Total Project Value

$1,508,479

DOE/Non-DOE Share

$1,508,479 / $0

Government funding for this project is provided in whole or in part through the American Recovery and Reinvestment Act.

AWARD NUMBER

FE0006220

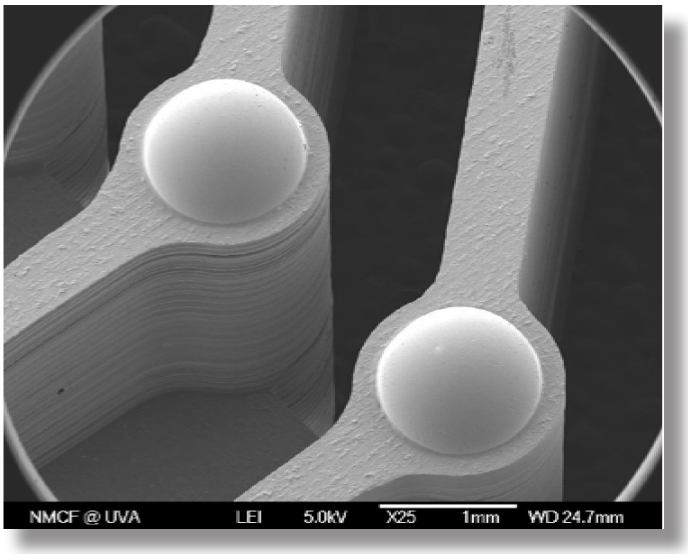
gas turbine. Concurrently, Siemens will redesign the 501F blade to improve the cooling properties, and new blades will be cast using Mikro Systems' core casting technology. Produced test blades will be evaluated through engine testing to qualify the TOMO process for commercial core production.

Goals/Objectives

The overall goal of this project is to demonstrate that Mikro's TOMO℠ technology can produce advanced turbine blade cooling features economically without disruption to current production methods and facilities. These objectives will also demonstrate the competitiveness of the technology, including cost, quality, and ability to produce advanced cores, and to foundry certify the production readiness of cores using an existing blade design from Siemens.

Accomplishments

Under a prior agreement with DOE, Mikro Systems demonstrated that the TOMO℠ process can lead to revolutionary new turbine cooling designs that can be developed faster and at significantly lower cost than current techniques allow. This new phase of ARRA funding will enable Mikro Systems to obtain a commercial contract for core production. Recent accomplishments are as follows:



Advanced 3D trailing edge feature (ceramic core)

- Technical discussions have been held with Siemens and PCC (Precision Castparts Corp.).
- Program owners have established roles and responsibilities for assigned project tasks.
- Year 1 foundry quotes have been completed.
- Mikro has issued a purchase order to PCC for engineering support and initial casting trials.
- CAD models and other foundry requirements are nearing completion.
- A joint planning meeting for manufacturing was held, and tooling production at Mikro has begun.

Benefits

The SBIR program is positioned to leverage the agility and innovative competencies of small businesses. It is through this program that a small company, Mikro Systems in Charlottesville, Virginia, has developed a way to revolutionize the investment casting process of the gas turbine industry. The Mikro Systems approach is break-through technology for both development and manufacturing of ceramic casting cores. It enables faster and lower-cost development of advanced gas turbine blades, and the process can be scaled-up for volume production. Further, Mikro Systems technology supports design features that are not possible with conventional core casting technology. ARRA investment in this small business will likely result in more US jobs as well as gas turbines for the electric power generation industry that are more efficient, cost less, and have lower emissions of criteria pollutants as well as CO_2.