Advanced Microturbine Systems

The U.S. Department of Energy Office of Distributed Energy and Electricity Reliability is currently leading a national effort to design, develop, test, and demonstrate a new generation of microturbine systems that are much cleaner, more affordable, more reliable, and more efficient than products that are commercially available today.

Goals:

High Efficiency – Fuel-to-electricity > 40% LHV

Environment – NO_x emissions < 7 ppm when using natural gas

Durability – 11,000 hours of operation between major overhauls and a service life of at least 45,000 hours

Cost of power – Installed cost < $500 per kilowatt (cost of electricity competitive with alternatives)

Fuel Flexibility – ***Multiple*** fuel capacity

Advanced Microturbine Development:

General Electric

Capstone

Ingersoll Rand

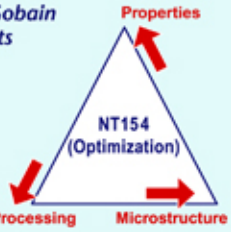
New Program Activities:

- Kennametal and Saint-Gobain Ceramics and Plastics were awarded new contracts to modify and upgrade existing lower-temperature sialon and silicon nitride materials for higher-temperature turbine applications.

Saint-Gobain Ceramics and Plastics

Objective – Develop and optimize a high temperature ceramic material and process suitable for microturbine applications up to 1300°C

Saint-Gobain products



Property Goals

- Fast Fracture
  RT – σ ≥950 MPa
  1300°C σ ≥ 600 MPa
- Fracture Toughness ≥ 6.5 MPa $\sqrt{m}$
- Weibull Modulus ≥ 12

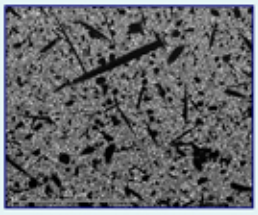
- High Temperature Creep Rate ≈1.9 x 10^{-8} @ 1250°C/130 MPa
- Oxidation Resistance up to 1250°C
- Recession Resistance in humid environment up to 1250°C

Kennametal

Objective – Modify and upgrade existing low-temperature sialon for turbine applications

Sialon cutting tool

- Component fabrication via ***low-cost*** sintering process
- Tailor sialon properties to meet demands of microturbine applications



β reinforced α sialon

- Optimize grain boundary composition for improved environmental stability

Contact Information:

D. P. Stinton
(stintondp@ornl.gov) Phone (865) 574-4556
Oak Ridge National Laboratory, Oak Ridge, TN 37831-6065

R. Yeckley (russ.yeckley@kennametal.com) Phone (724) 539-4822
Kennametal, Inc., Latrobe, PA 15650

R. H. Licht (Robert.H.Licht@saint-gobain.com) Phone (508) 351-7815
Saint-Gobain Cearmics & Plastics, Inc., Northboro, MA 01532

Office of Distributed Energy and Electricity Reliability

http://www.eren.doe.gov/der/microturbines/microturbines.html

ORNL 2003-02088/dgc