Microturbine Materials

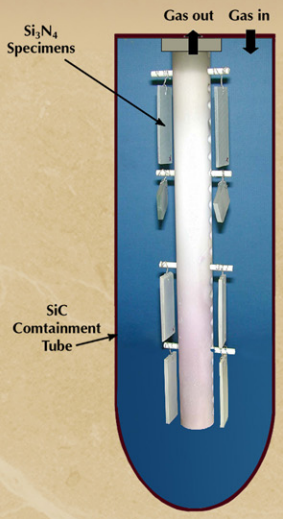
The objective of this collaborative program is to develop corrosion-resistant materials for hot-section components of advanced, high-efficiency microturbines. These materials will need to be stable for extended periods in microturbines operating at temperatures between 1800° and 2400°F and pressures to 10 atm that contain steam

ORNL will expose candidate silicon nitrides produced by Honeywell and Kyocera to relevent temperatures and water vapor pressures in the ORNL Keiser Rig. Specimens will be evaluated at ORNL and the University Dayton using SEM, TEM, X-ray diffraction, and flexure testing

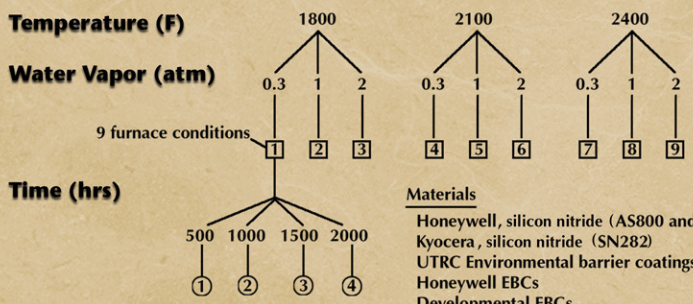
Primary suppliers of silicon nitrides for gas turbines

Honeywell Ceramic Components

Kyocera Industrial Ceramic Corporation



A collaborative effort between the silicon nitride supplies, Capstone, GE, Honeywell, IR Energy Systems, and UTRC identified potential operating conditions for advanced, high-efficiency microturbines

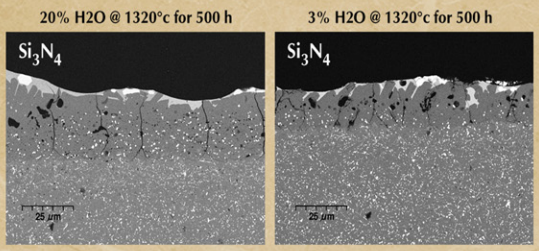


Materials

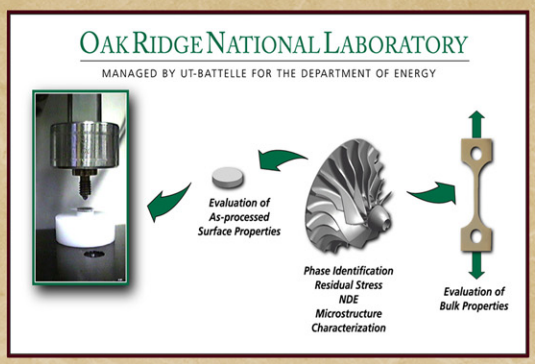
- Honeywell, silicon nitride (AS800 and AS950)
- Kyocera, silicon nitride (SN282)
- UTRC Environmental barrier coatings (EBCs)
- Honeywell EBCs
- Developmental EBCs

Understanding The Effects of Elevated Temperatures and Water Vapor Pressures On

- Silicon nitride recession (oxidation rates) as $f(T, p_{H_2O})$
- Intergranular phase stability
- Retained strength
- Environmental barrier coating (EBC) effectiveness and stability with silicon nitride in corrosive environments



Damage at surface of Si3N4 coupons exposed for 500 h at 1320°C in ORNL's Keiser Rig



ORNL will evaluate the mechanical properties of actual ceramic components after exposure to controlled environments and after field testing

ORNL and UDRI will evaluate the mechanical properties of monolithic and EBC silicon nitride exposed to simulated microturbine operating conditions

Office of Power Technologies

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