SwRI®

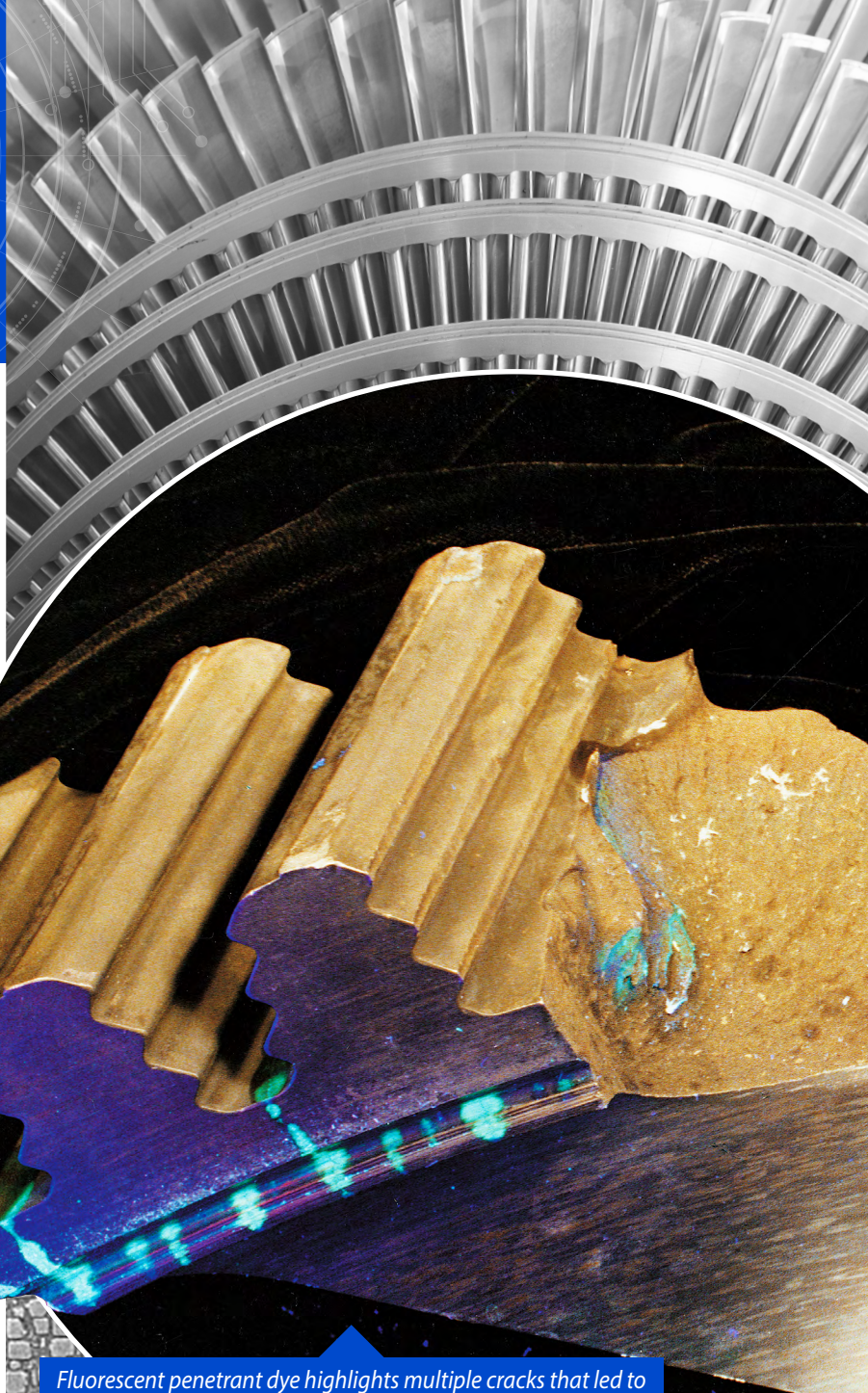
SOUTHWEST RESEARCH INSTITUTE

Turbomachinery Material Analysis and Testing

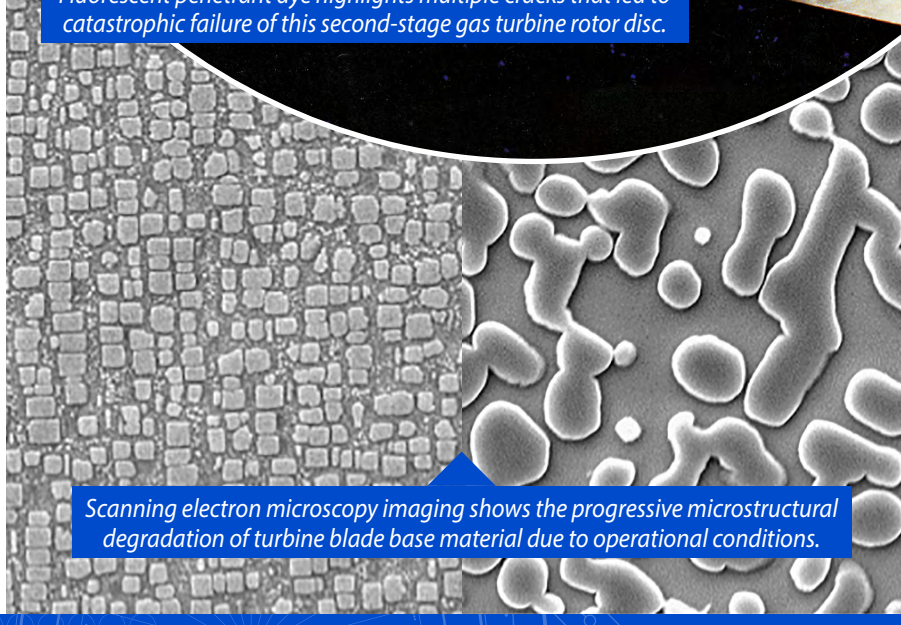
Turbomachinery operates at extreme conditions, often at the design limit of components such as turbine blades, bearings, and rotors. Analysis of damaged or failed components with advanced materials for both substrates and coatings requires an integrated approach to understanding the material, environmental, and operational conditions that contributed to the failure.

For more than 50 years, Southwest Research Institute® (SwRI®) engineers have conducted coordinated, multidisciplinary investigations of turbomachinery failures and related materials characterization and testing. SwRI has extensive expertise in turbomachinery materials and comprehensive analytical and test capabilities including:

- **Metallurgical examinations** of failed components to determine active damage mechanism(s) and initiation sites, generate remaining life estimations from fractography, and compare measured material properties against specification requirements.
- **Mechanical testing** of turbomachinery materials to better predict structural performance in application. SwRI has broad expertise in fatigue and fatigue crack growth rate testing in environments including high humidity, high temperatures, and high pressures.
- **Fracture mechanics** and fatigue crack growth software for deterministic and probabilistic prediction of safe operating lifetime and failure conditions. The SwRI-developed NASGRO® and DARWIN® programs are widely used in the turbomachinery industry.
- **Environmental monitoring** to provide advance warning of potential corrosion problems. Corrosion sensors or witness coupons can alert equipment operators when ingested air is causing corrosion rates to be higher than expected.
- **Corrosive environment material qualification testing** to ensure that selected materials are appropriate for their intended service environments, which may include high temperatures, high pressures, and aggressive chemistries.

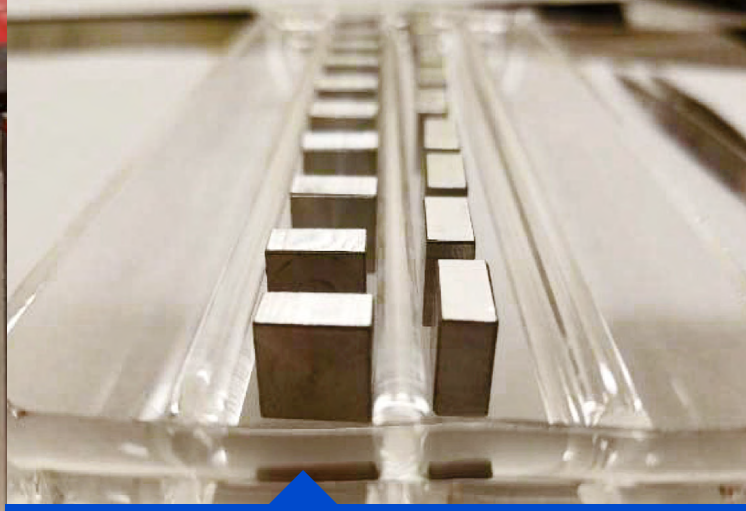


Fluorescent penetrant dye highlights multiple cracks that led to catastrophic failure of this second-stage gas turbine rotor disc.



Scanning electron microscopy imaging shows the progressive microstructural degradation of turbine blade base material due to operational conditions.

A creep frame measures mechanical properties of turbine materials in aggressive gaseous and liquid environments.



Metallic coupons are prepared for oxidation/sulfidation testing in gaseous hydrogen sulfide at elevated temperature and pressure.

An SwRI technician prepares environmental test cells to simulate corrosion attack under service conditions.

We welcome your inquiries. For additional information, please contact:

John H. Macha
Senior Research Engineer
210.522.3163
john.macha@swri.org

Materials Engineering Department
Mechanical Engineering Division

mateng.swri.org

Southwest Research Institute

Southwest Research Institute is a premier independent, nonprofit research and development organization using multidisciplinary services to provide solutions to some of the world's most challenging scientific and engineering problems. Headquartered in San Antonio, Texas, our client-focused, client-funded organization occupies 1,200 acres, providing more than 2.3 million square feet of laboratories, test facilities, workshops, and offices for more than 2,600 employees who perform contract work for government and industry clients.

210.522.2122

ask@swri.org

Like. Share. Follow. Listen.

swri.org

Designed & printed by SwRI MPS 18-0819 JCN 262197 tp