



# Thermal Properties Characterization

ENGINEERING



Southern Research has been a national leader in the thermal properties characterization and evaluation of high temperature materials for more than 55 years. The staff of the Thermal Properties Laboratory have performed tests on a variety of materials including composites, ceramics, metals, insulations, and lubricants under normal and in extreme environments at temperatures from cryogenic to over 5500°F.



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### ■ **Thermal Expansion**

- NBS quartz tube dilatometer (-320 to 2000°F, vacuum, pressure, air, inert)
- Horizontal quartz rod dilatometer (-450 to 2000°F, air, inert)
- Graphite tube dilatometer (RT to 5500°F, vacuum, pressure, inert)
- Cryogenic ring (-320 to 250°F, inert)
- High-temperature ring (RT to 5000°F, inert)
- Yarn/filament/fiber (RT to 5000°F, air, inert)

### ■ **Thermal Conductivity**

- ASTM C177 guarded hot plate (-360 to 600°F, vacuum, load, air, inert)
- Comparative rod apparatus (-350 to 2000°F, vacuum, load, air, inert)
- Radial inflow apparatus (1500 to 5000°F, vacuum, load, inert)
- Pressure radial inflow apparatus (70 to 800°F, up to 5000 psi atmosphere)

### ■ **Heat Capacity**

- Adiabatic Calorimeter (-450 to 1000°F, Air, Inert)
- Ice Calorimeter (1500 to 5000°F, Inert)
  - › Also see DSC

### ■ **Yarn/Fiber Properties**

- Creep (RT-5000°F, air, inert)
- Stress rupture (RT-5000°F, air, inert)

### ■ **Specialty Thermal Testing**

- Total normal emittance (1500 to 5000°F, inert)
- Thermogravimetric analyzer (TGA) (25 to 1200°C, air, inert, vacuum)
  - › Ballistic heating (>2000°C/min)
  - › Modulated mode
- Laser diffusivity (RT to 2100°F, vacuum)
- Heat-treatment furnaces (to 5750°F)
- Differential scanning calorimetry (DSC)
  - › Standard mode (-90 to 725°C, air, inert)
  - › Modulated mode (-90 to 725°C, air, inert)
  - › High-temperature (40 to 1250°C, air, inert, vacuum)

### ■ **Electrical Resistivity**

- High-temperature coupon (RT to 5000°F)
- RT yarn/filament facility
- High-temperature yarn/filament (RT 5000°F)

### ■ **Precision Cryogenic Thermal Expansion**

Southern Research has developed a unique facility for measuring thermal expansion with ultra-high accuracy from 300 K to below 30 K. Using interferometers and a proprietary optical flagging system, CTE accuracy of better than 20 parts-per-billion is standard. For materials that do not tend to bend or flex, CTE accuracy of better than 10 parts-per-billion is possible (based on 8-inch sample with 20 K delta T). Sample sizes can range from 1 cm to 1 meter.



#### **ABOUT SOUTHERN RESEARCH**

Founded in 1941 in Birmingham, Alabama, Southern Research is a scientific and engineering research organization that conducts preclinical drug discovery and development, advanced engineering research in materials and systems development, and energy and environmental technologies research. SR supports clients and partners in the pharmaceutical, biotechnology, defense, aerospace, environmental, and energy industries.

We pursue entrepreneurial and collaborative initiatives to develop and maintain a pipeline of intellectual property and innovative technologies that contribute to the growth of the organization and positively impact real world problems.

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