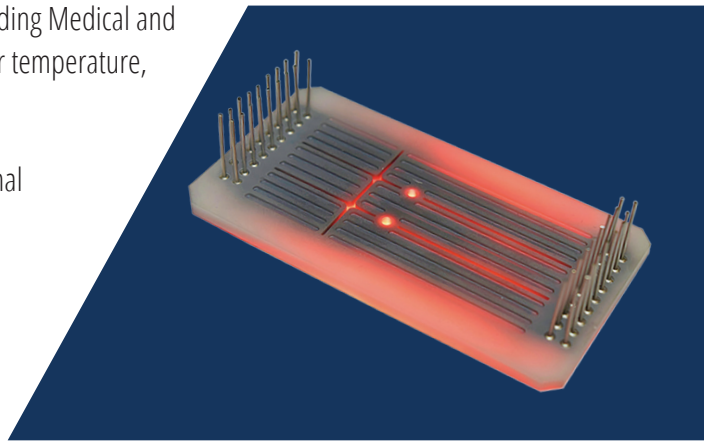
FRALOCK® *Leading the Way in Advanced Materials Solutions*

FRALOCK HEATERS FOR MEDICAL APPLICATIONS

Fralock provides custom-engineered heating solutions used in today's most demanding Medical and Life Sciences applications. We offer multiple material constructions to optimize your temperature, thermal control, and packaging requirements.



Ceramic Heaters are designed for thermal uniformity and extremely rapid thermal cycling in precision medical equipment.

Polyimide Heaters provide high flexibility, low mass, and can be shaped and formed to solve complex packaging challenges.

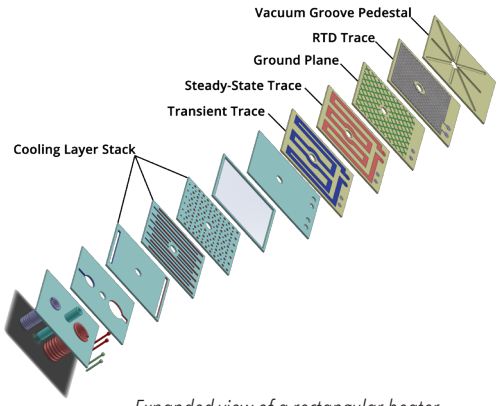
Heater Types and Properties

Heater Type	Temperature Range	Material	Structural Formats	Power Density
Ceramic AIN	Up to 650°C	AIN, Tungsten	Platens or tubular	Small format 2KW/sq in 300 mm 10- 15kW Pending configuration
Flexible Polyimide	-269°C to +220°C	Polyimide, multiple adhesive options	Flat, formed to most surfaces	40 W/sq in +

CERAMIC HEATERS

Fralock Ceramic heaters are made using high thermal conductivity Aluminum Nitride (AlN) with embedded Tungsten resistance heating traces, providing tailored power input to achieve your temperature transition goals.

Extremely rapid heating in excess of 300°C/sec is made possible because the coefficients of thermal expansion of Aluminum and Tungsten are equal (4.3 x 10^{E-6} Co). Integrated channel structure and low density AlN ceramic provide quick cooling rates, from 300°C to room temperature in a just few seconds.



Expanded view of a rectangular heater

	Aluminum Nitride	Tungsten
Density - g/cc	3.36	19.3
Linear Coefficient of Expansion per °C	4.3 x 10^{E-6}	4.3 x 10^{E-6}
Thermal Conductivity (RT) - W/mK	180	170

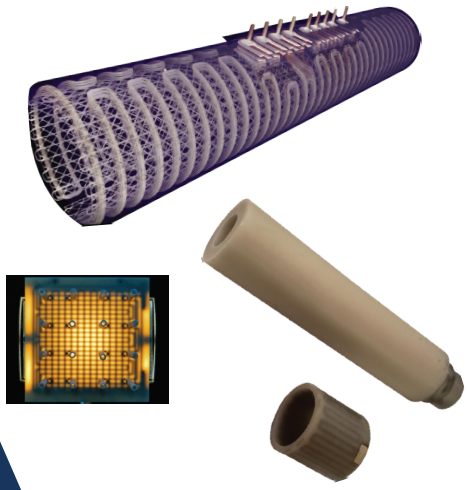
Exceptional thermal uniformity and seamless transfer of temperature is achieved due to matched coefficients of thermal conductivity

Applications Include

- Polymerase Chain Reaction Equipment
- Mass Spectrometry Equipment
- In-Vitro Diagnostics Equipment
- Tissue Fusion
- Packaging and Sealing Applications

FEATURES AND BENEFITS

- Robust reliability, proven with millions of cycles in the field
- Multiple zones of heater and sensor traces in various layers
- Tungsten traces are fully integrated and chemically bonded into the AlN microstructure
- Ground plane shielding
- Thin substrates: flat, round or any that geometry can be CNC milled
- Complex geometries that include venting, vacuum, and blind features
- Large format sizes up to 380mm diameter
- Internal cooling channels
- Sub-micron flatness possible

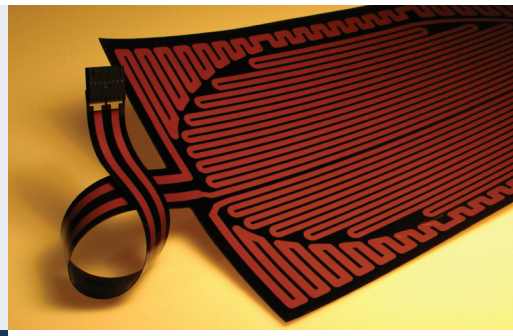


POLYIMIDE HEATERS

Fralock's polyimide heaters can be fabricated using multiple material configurations to meet your needs. Thermal management can be assembled to the surface of the heater, or embedded inside for a one-piece solution. There are also several mounting options available to ensure quick and effective heat transfer.

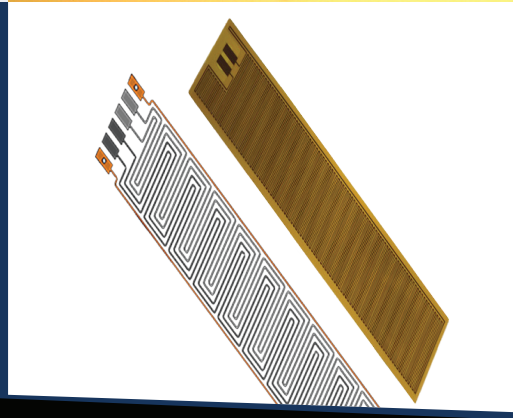
Applications Include

- Immunoassay Analyzers
- Liquid and Gas Warming
- Pathogen Detection
- Battery Warming
- Optics Defogging



FEATURES AND BENEFITS

- Several dielectric and foil options available. Heaters as thin as 0.0635mm (.0025")
- Flexibility for heating complex, three-dimensional applications
- Multi-layer and multi-zone heating; can include embedded thermocouples
- Excellent temperature range -269°C to +220°C
- Low out-gassing



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