

FRALOCK HEATERS FOR MEDICAL APPLICATIONS

Fralock provides custom-engineered heaters for critical equipment and devices used in a variety of Medical and Life Sciences applications. We offer three distinct material technologies that enable you to select the most effective engineered solution.

Ceramic Heaters are designed with thermal uniformity and extremely accurate thermal cycling for precision medical equipment.

Polyimide Heaters provide high flexibility in shape and design for operation where thermal uniformity in narrow spaces is needed.

Stainless Steel Heaters are formulated with a Borosilicate glass dielectric layer which enables high temperature generation and robust electrical connections for lower costs.



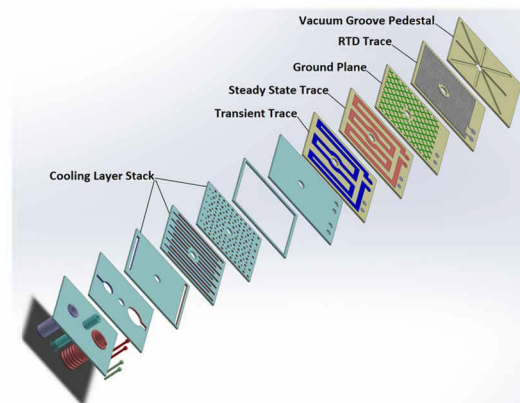
Heater Types and Properties

Heater Type	Temperature Range	Material	Structural Formats	Power Density	Relative Cost
Ceramic AlN	Up to 650°C	AlN Tungsten	Platens or tubular	Small format 2KW/sq in 300 mm 10- 15kW Pending configuration	\$\$\$
Flexible Polyimide	-269°C to +220°C	Bonded Polyimide Layers	Flat, formed to most surfaces	40 W/sq in	\$
Stainless Steel/Glass	Up to 450°C	Borosilicate Glass, Stainless Steel	Platens or tubular	40 W/sq in	\$\$

CERAMIC HEATERS

Fralock Ceramic heaters are made using high thermal conductivity Aluminum Nitride (AlN) ceramic 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 (4.3×10^{-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.



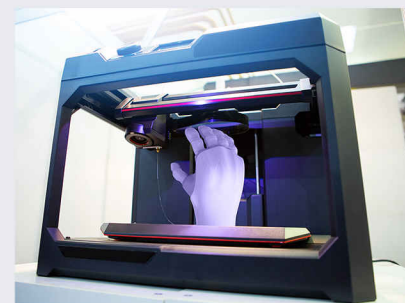
Expanded view of a rectangular heater

	Aluminum Nitride	Tungsten
Density - g/cc	3.36	19.3
Linear Coefficient of Expansion per °C	4.3×10^{-6}	4.3×10^{-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

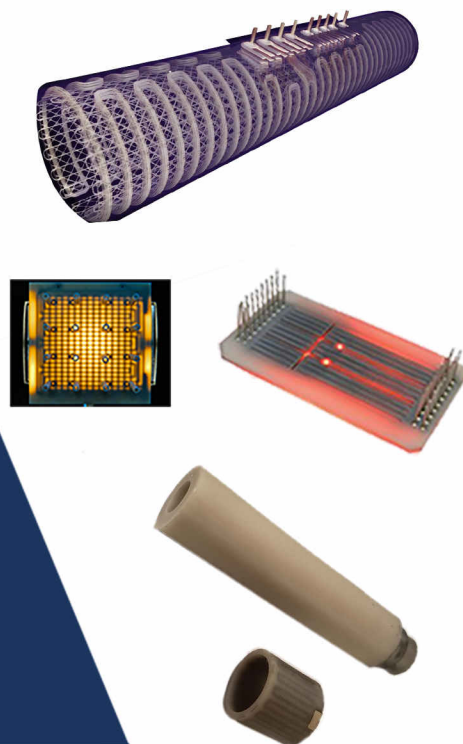
Applications Include

- Polymerase Chain Reaction Equipment
- Mass Spectrometry Equipment
- 3-D Printing
- Tissue Fusion
- Cryoablation
- Packaging and Sealing Applications
- Plastic Riveting/Welding



FEATURES AND BENEFITS

- Robust reliability, proven with millions of cycles in the field
- Multiple zones of heater and sensor traces in various layers
- Multiple resistance temperature detectors (sensors) focusing on specific locations
- Tungsten traces are fully integrated and chemically bonded into the AlN microstructure
- Tunable resistivity tungsten inks from 8-80 mOhm/square provide rapid resistance tuning for new product introduction
- Ground plane shielding
- Thin substrates: flat, round or any geometry can be CNC milled
- Complex geometry: venting, through blind features, and internal channels
- Large format sizes up to 380mm diameter
- Multi-zone heater and temperature sensor capability
- Internal gas delivery passages available



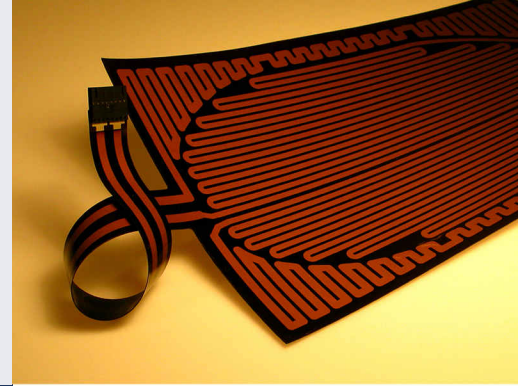
POLYIMIDE HEATERS

Fralock's polyimide heaters are manufactured with fully encapsulated traces using Fralock's Adhesiveless Laminate Technology, and are more efficient, thinner, lighter, and far more durable than any comparable product on the market. Polyimide heaters offer superior performance and durability for medical and life science applications.



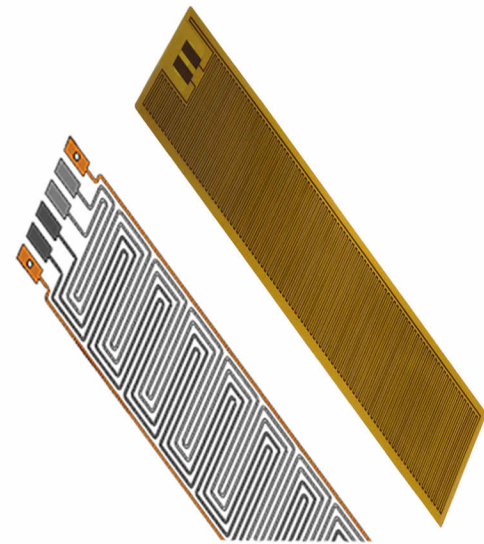
Applications Include

- Polymerase Chain Reaction Equipment
- Immunoassay Analyzers
- Liquid and Gas Warming
- Pathogen Detection
- Packaging and Sealing Applications



FEATURES AND BENEFITS

- High bond strengths that exceed substrate properties
- Flammability Rating, UL® 94VO
- Flexible construction – can be folded, wrapped, or crumpled without affecting performance
- Lightweight – constructions as thin as 0.0762 mm (0.003")
- Multi-layer and multi-zone (many, independently controlled, zones of heater traces across the entire surface)
- Excellent Temperature range -269°C to +220°C
- Very low out-gassing



STAINLESS STEEL HEATERS

We offer unique heaters engineered using a specialty formulated glass with the same coefficient of expansion as stainless steel. This provides superior adhesion and lifetime during thermal cycling. This glass is used as a dielectric platform to print a resistance circuit, which is covered again in glass.

Applications Include

- Packaging and Sealing Applications
- Sub 450°C Low Cost Applications

FEATURES AND BENEFITS

- Superior dielectric glass layers for lifetime reliability
- Flat and tubular configurations - various shapes and sizes can be fabricated
- Robust electrical connections
- Trace resistance customization
- Ground plane shielding
- Thin substrates: flat, round or any geometry can be CNC milled
- Robust reliability, proven with millions of cycles in the field

