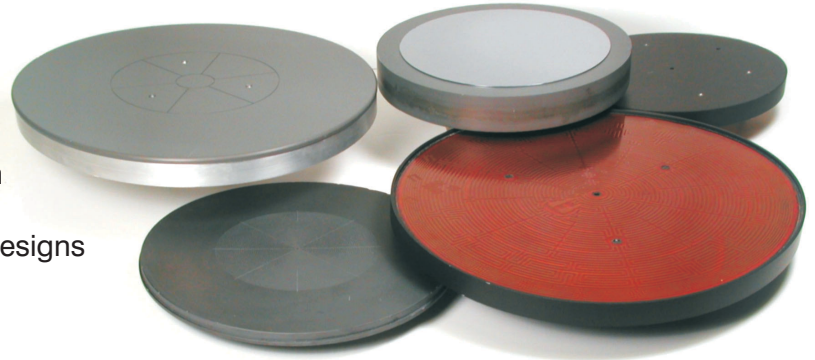


Chuck Heaters for Semiconductor Processing Equipment

- ◆ Precise heating for critical processes
- ◆ Etched elements allow thinner, low mass chuck designs
- ◆ Excellent chemical resistance
- ◆ Profiled element patterns produce uniform temperatures
- ◆ Faster warmup than conventional chuck designs
- ◆ Sealed elements prevent contamination
- ◆ Precision machined chucks to your exact specifications



Thermal design: The Minco Thermofoil™ advantage

Etched element Thermofoil™ heaters from Minco provide the proven solution to the problems of heating process chucks for semiconductor processing machines. The thin profile heater allows designers to specify designs that have lower mass than bulky, cast metal chucks.

Minco's thinner, low-mass chucks offer several advantages in processing machines:

- Faster time response, allowing faster in-line process changes
- Lower total power requirements to reach required temperatures
- Lower profile means more process stations can be stacked into the same vertical space

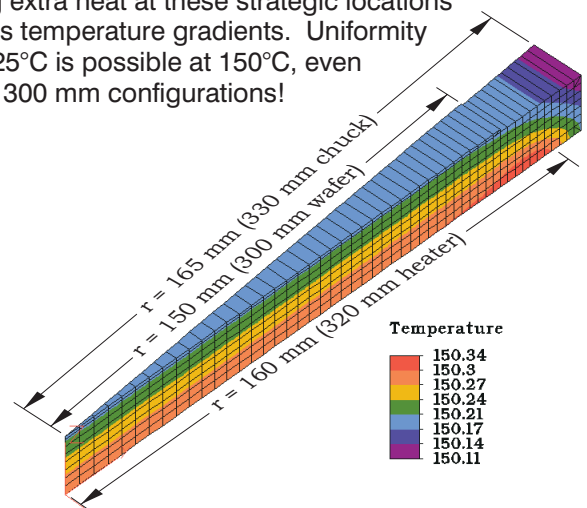
Minco heater assemblies can be configured for almost any process. You can use 260°C polyimide insulated heaters for photoresist processing, etching, and testing. 600°C mica heater assemblies are ideal for CVD and PVD processes.

Mechanical design: Minco builds custom solutions

A major consideration in designing fast response, low mass chucks is the dimensional stability of various materials at elevated temperatures. Minco's extensive data, testing capabilities, and expertise in thermal design have identified specific metal materials and alloys that allow us to meet demanding requirements for flatness and stability.

Minco can supply plates of specialized aluminum alloys, ceramics, or non-metallic materials that provide performance beyond the limits of cast aluminum assemblies.

Etched elements can be profiled in a repeatable pattern to compensate for heat losses around edges and holes. Adding extra heat at these strategic locations reduces temperature gradients. Uniformity of $\pm 0.25^\circ\text{C}$ is possible at 150°C , even across 300 mm configurations!



This FEA cross section of a heated plate shows a temperature difference of less than 0.10°C from center to edge.

The versatility and repeatability of the etched element construction allows complex machined features, including vacuum ports, proximity pins, and exceptional surface finish requirements.

Custom design options include integrated temperature sensors with either point or averaging designs. Minco can build RTD, thermocouple, or thermistor sensors to match your instrumentation.

Hermetically sealed lead connections and vacuum feedthrough assemblies are available to complete the design.

Design & testing services: Concept-to-completion

In addition to creating and building heater assemblies Minco offers finite element analysis (FEA), thermal imaging, and testing services using instrumented wafers to optimize designs.

FEA allows us to model a design before building the first prototype. Heat loss data, process requirements, and process chamber environmental conditions can be used to give the most accurate results. Computer imaging may be used to help identify problems and show how design changes will affect the finished product.

Minco can test actual wafer and chuck performance using instrumented wafers on chucks under vacuum or

atmospheric conditions. These tests allow us to simulate chamber conditions during prototype design resulting in more accurate final designs.

Minco engineers work with you to develop a design that meets your needs, then our complete production facilities (ISO 9001 certified) provide reliable and consistent product. With over 40 years of temperature sensing and thermal design experience, Minco offers unparalleled capabilities designing accurate heating and temperature measurement systems.

Typical construction and applications



Machined Aluminum plate with All-Polyimide heater

260°C Temperature capability

Construction:

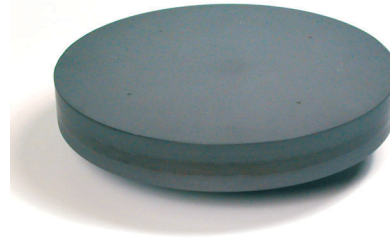
Etched element heater with polyimide insulation permanently laminated to a machined aluminum plate.

Features:

- High dielectric strength
- Excellent chemical resistance
- Available with UL component recognition

Typical applications:

- Photoresist bake stations
- Electrostatic chucks
- "Shower Head" gas dispersion systems



Welded Aluminum plate with Mica insulated heater

500°C Temperature capability

Construction:

Etched element heater with mica insulation welded into a sealed assembly.

Features:

- True hermetically sealed construction for vacuum processes
- Design options include integral stems or vacuum feedthroughs

Typical applications:

- Dry etch processes
- CVD
- PVD
- Ashing

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