

# CERAMIC HEATERS



***Fullchance's Ceramic Heaters are characterized by their compact design, ability to generate heat rapidly, and high reliability under harsh environments.***

### ***Alumina Heaters***

The Alumina Heater is produced by implementing unique metallizing and ceramic laminating processes. Due to the advanced manufacturing techniques in the electric element, the Alumina Heater can provide higher reliability than ever before. It is being used, as an innovative type of heater, in such industries as Automotive, Medical, and Semiconductor.

### ***Silicon Nitride Heaters (SN Heaters)***

Silicon Nitride material has high temperature strength, and outstanding thermal shock resistance. Fullchance was the first company in the world to commercialize and mass produce the ceramic glow plug, made of Silicon Nitride, for the diesel engine. Due to its outstanding performance, the Silicon Nitride heater is effectively used in a wide range of industrial fields.



*Alumina Heaters*



*Silicon Nitride Heaters (SN Heaters)*

## The Advantages of Ceramic Heaters

Fullchance's ceramic heaters have unparalleled advantages over conventional heaters.

### Compact and Light Weight

- High watt density
- Multiple heating elements per unit available

### Superior Thermal Properties

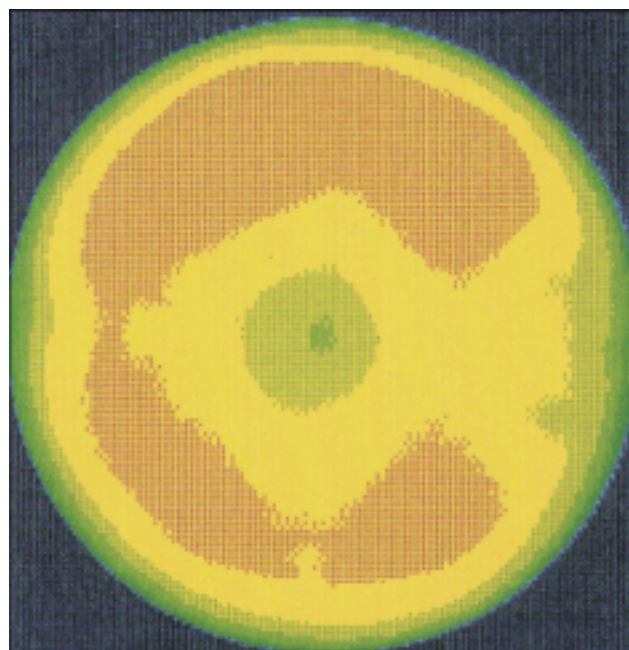
- Rapid Heat Increase
- Custom designed temperature distribution available
- High levels of insulation allow direct contact with metal and water
- SN Heater: Heat increase to 1000°C in one second with controller

### High Reliability

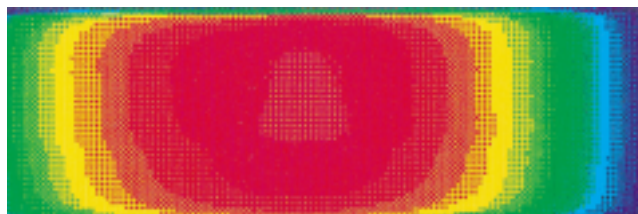
- Superior dielectric strength and volume resistivity
- Longer life due to oxidation-proof design on resistive material
- Superior chemical resistance

### Environmental Qualities

- No electric noise
- Energy-saving due to the superior thermal efficiency



Thermal distribution of Alumina Heater

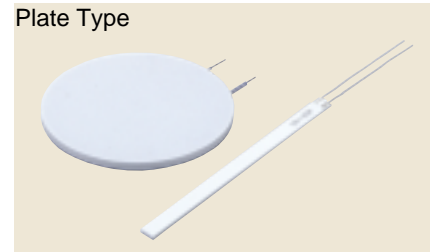
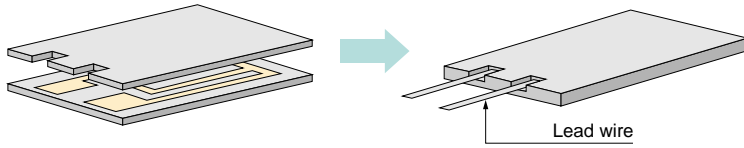


Thermal distribution of SN Heater

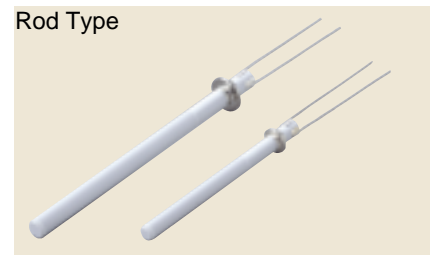
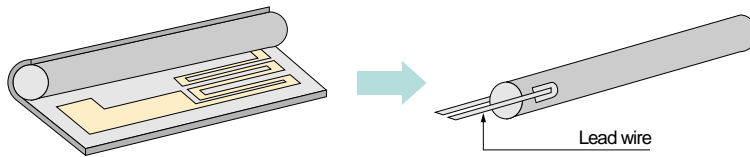
## Design Structure

Ceramic heaters are manufactured by printing resistors on alumina sheets or silicon nitride plates, being laminated and sintered into one piece.

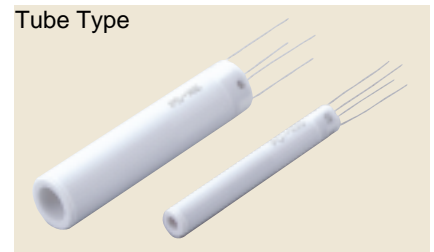
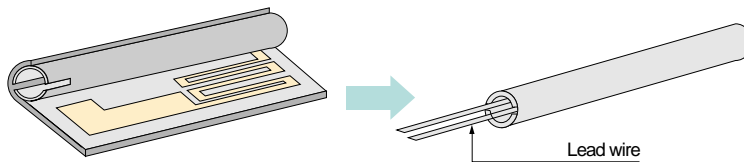
### ●Plate Type



### ●Rod Type



### ●Tube Type



## Configuration and Dimensions

	Configuration	Dimension (mm)			Tolerance (mm)	Camber (mm)
		Length	Diameter		Length $\ell$ 50min. $\pm$ 1% $\ell$ 50max. $\pm$ 0.5	
Alumina Heater	Tube/Rod	$\ell$ 120max	$\phi$ 2min~ $\phi$ 50max		Diameter $\phi$ 10min. $\pm$ 2% $\phi$ 10max. $\pm$ 0.2	0.4/100
		$\ell$ 200max	$\phi$ 3min~ $\phi$ 20max			
Alumina Heater	Plate or Square/Round	Side or Diameter	Thickness		Side or Diameter 20min. $\pm$ 1% 20max. $\pm$ 0.2	0.4/100
		160 $\times$ 160 or $\phi$ 160	0.3min $\ell$ 5.4max		Thickness 1min. $\pm$ 10% 1max.0.1	
SN Heater	Plate	Length ( $\ell$ )	Width (w)	Thickness (t)	Length $\pm$ 3% Width $\pm$ 3% Thickness $\pm$ 10%	0.4/100
		30~100	4~50	1~20		
Configuration						

※ Note: Will comply to other requirements besides the above described, whenever required.

## Thermal Properties

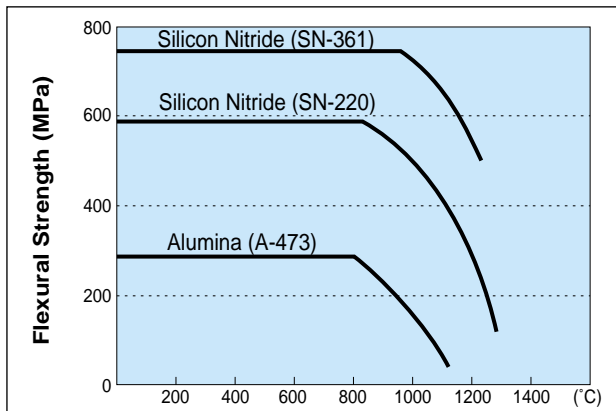
Item		Alumina Heater (A-473)	SN Heater (SN-361)
Maximum Use Temperature	°Cmax	1,000	1,400
Operating Temperature	°Cmax	800	1,300
Thermal Conductivity <sub>20°C</sub>	w/(m•k)	18	25.0
Specific Heat	J/(kg · k)	$0.75 \times 10^3$	$0.64 \times 10^3$
Coef. of Linear Thermal Expansion /°C (40~800°C)		$7.8 \times 10^{-6}$	$3.4 \times 10^{-6}$

## Mechanical Properties

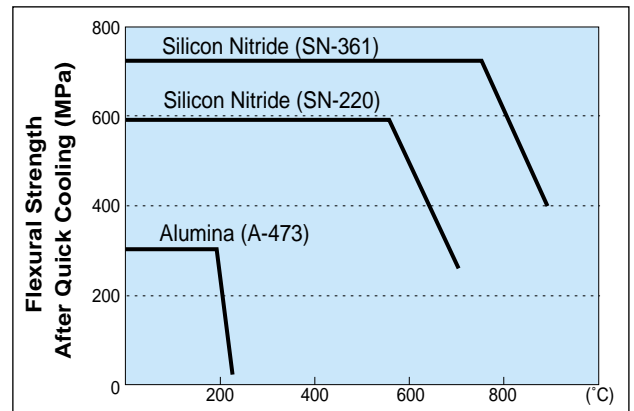
### ■ Properties

Item		Alumina Heater (A-473)	SN Heater (SN-220)	SN Heater (SN-361)
Vickers Hardness (Load 500g)	GPa	13.7	14.7	17.1
Flexural Strength	MPa	310	590	740

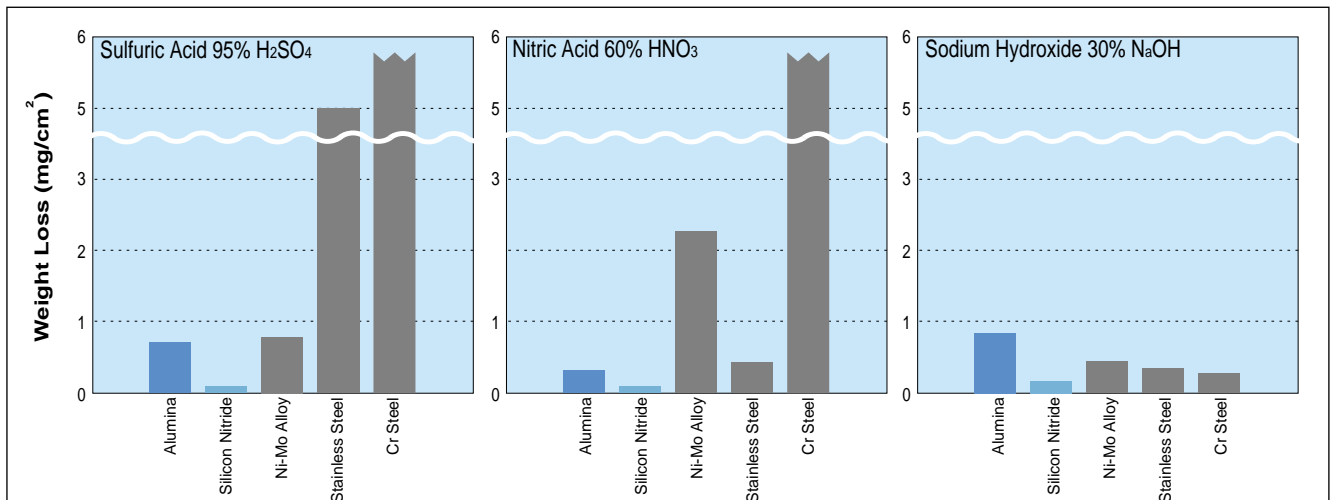
### ■ High Temperature Strength



### ■ Thermal Shock Durability



## Chemical Durability

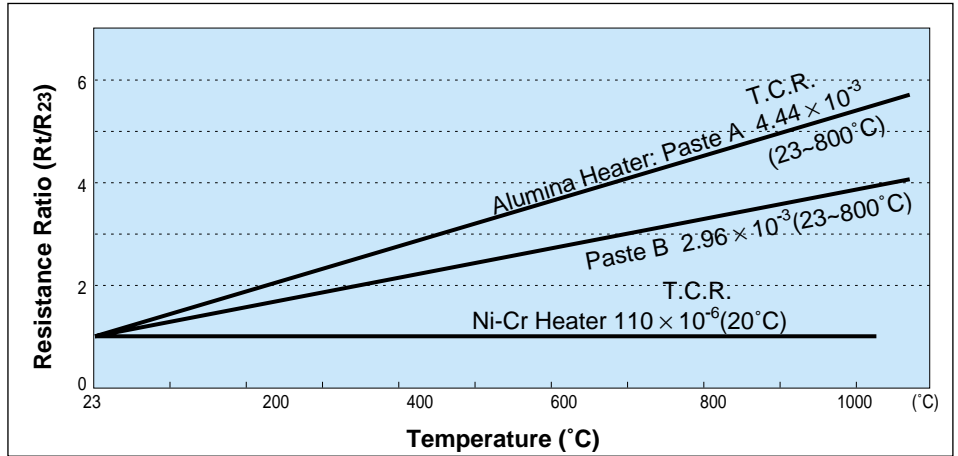


# Electrical Properties

## 1. Thermal Coefficient of Resistivity

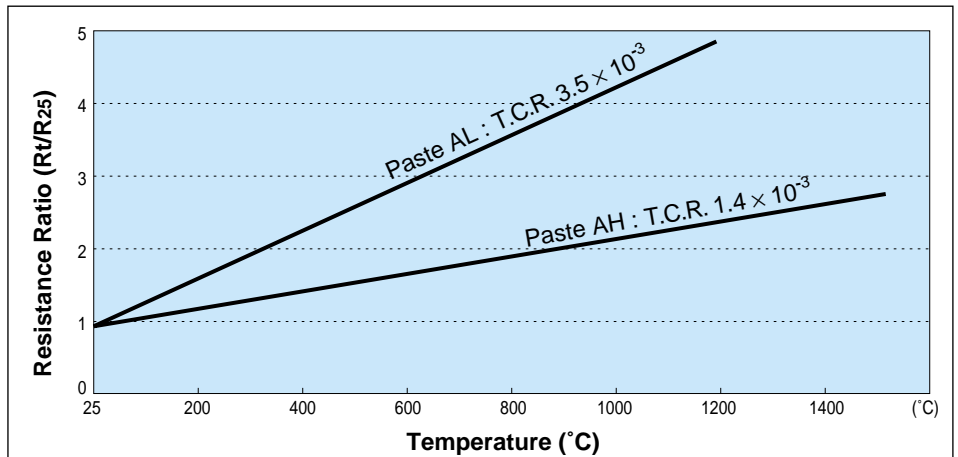
### ● Alumina Heater

Resistance Ratio vs. Temperature

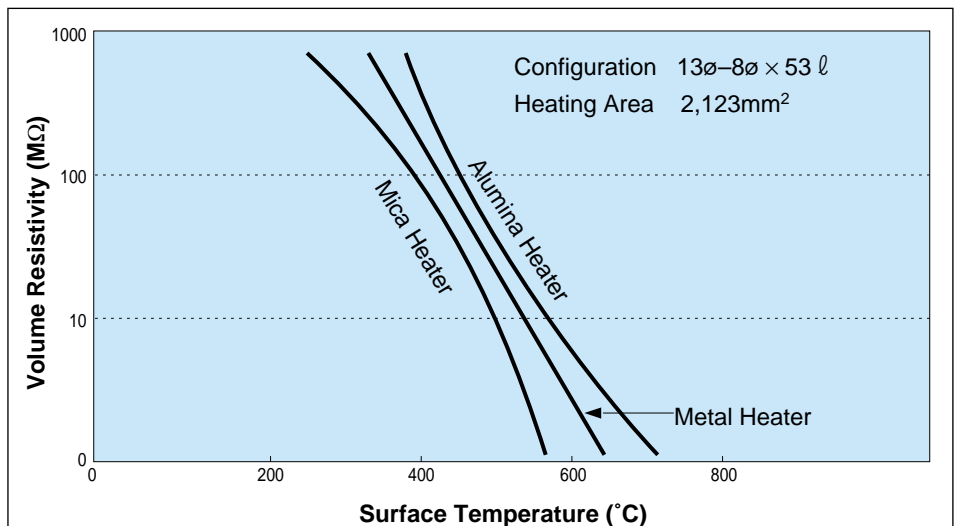


### ● SN Heater

Resistance Ratio vs. Temperature



## 2. Dielectric Strength



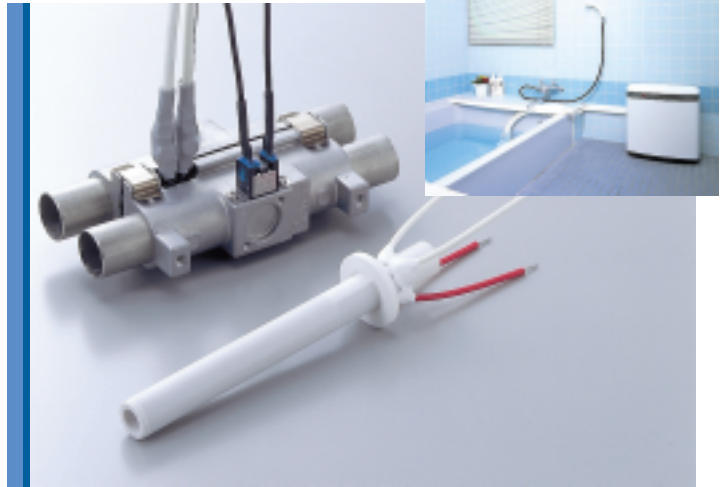
# Applications

## Automotive Related Heater Applications



Glow Plug

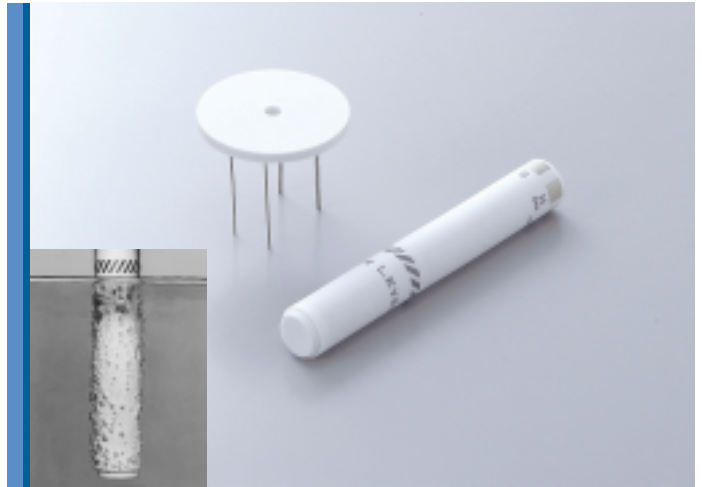
## Water-Heating Applications



Hot Water Heater



Intake (Burner) Heater



Liquid Heater for Small Appliances



Others



Heater for Toilet Water

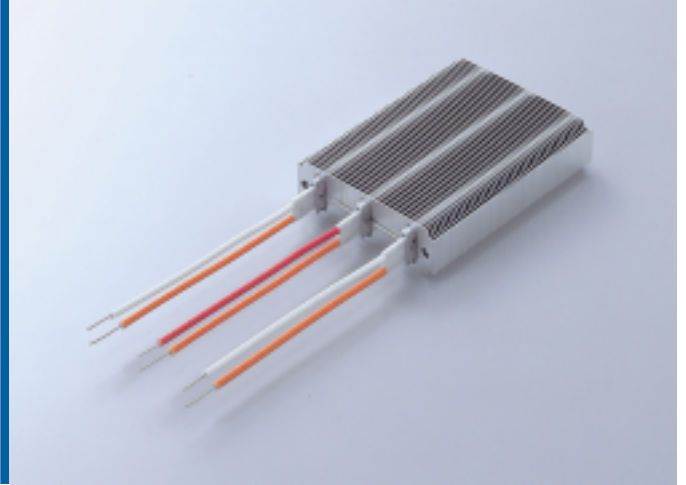


# Applications

## Other Industrial Heater Applications



Soldering Iron



Air Heater



Curling Iron



IR Source & Igniter



Steam Boiler Heater



Vaporizer