Zirnox

Zirconium Oxynitride Cryogenic Temperature Sensor

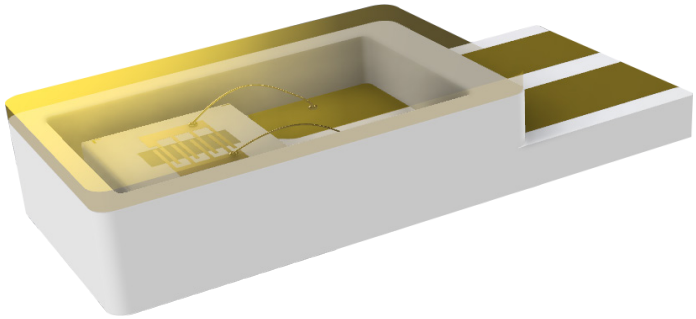
SCIENTIFIC INSTRUMENTS

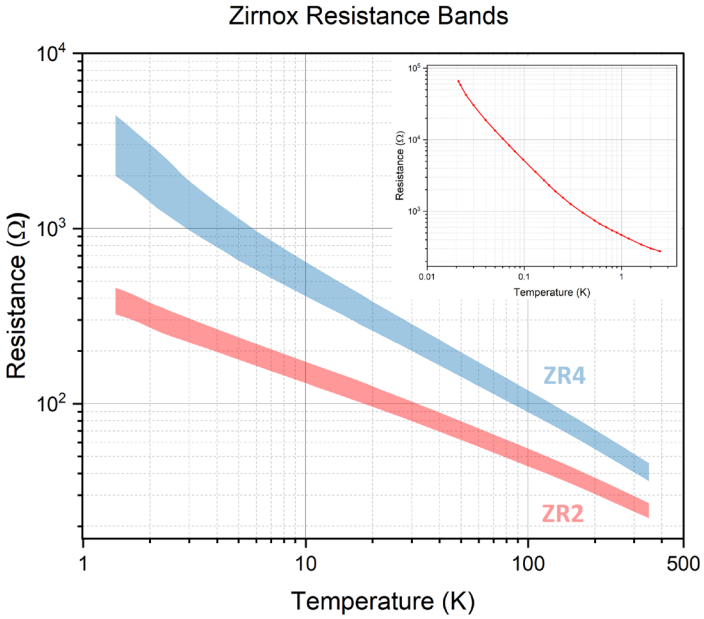
Zirnox is a thin film resistive temperature sensor that can operate over a wide temperature range (0.1K to 450K) and exhibits negligible calibration shifts when exposed to magnetic fields and ionizing radiation environments. Comprised of zirconium oxynitride, the material and physical properties of the sensor provide fast thermal response and exceptional heat transfer. Zirnox packaging is highly customizable and can be tailored to fit your application needs.

*Radiation ULT data subject to change and available upon release

Key Features

- High Sensitivity
- Fast Thermal Response
- Excellent Short-Term and Long-Term Stability
- Reliable and Wide-Ranging
- UHV Compatible (10^{-10} Pa)





Thermal Response Time

0.093" Copper Canister, 300K → 4K : 3.931 Secs (62.5%)
0.093" Copper Canister, 77K → 4K : 0.412 Secs (62.5%)

Zr2	Zr4
0.066%, 2 T	0.12%, 2 T
0.31%, 5 T	0.000%, 5 T
0.38%, 10 T	0.18%, 10 T
1.5%, 15 T	1.05%, 15 T

*Typical errors $\Delta T(H)/T_o$ @ 4K due to the magnetic field for Zr2 & Zr4

Available Configurations

Calibrated "NN"
(Range 1.4K to 360K)

+/- 0.005K from 1.4K to 10K
+/- 0.01K from 10K to 25K
+/- 0.03K from 25K to 100K
+/- 0.05K from 100K to 360K

Calibrated "E" *ZR2 Only*
(Range 0.1K to 360K)

+/- 0.005K from 0.1K to 10K
+/- 0.01K from 10K to 25K
+/- 0.03K from 25K to 100K
+/- 0.05K from 100K to 360K

Uncalibrated Configurations Available Upon Request

*Data is subject to change as a result of product improvement

*Resistance values of uncalibrated Zirnox cannot be guaranteed below 4.2K

High Temperature Calibration Option Available Up To 450K

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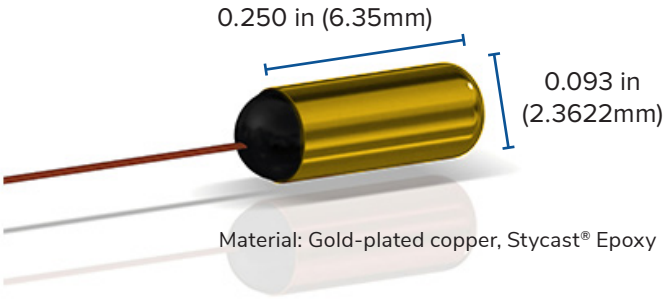
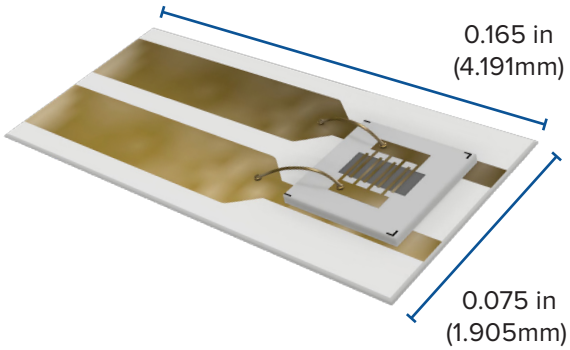
Canister Package

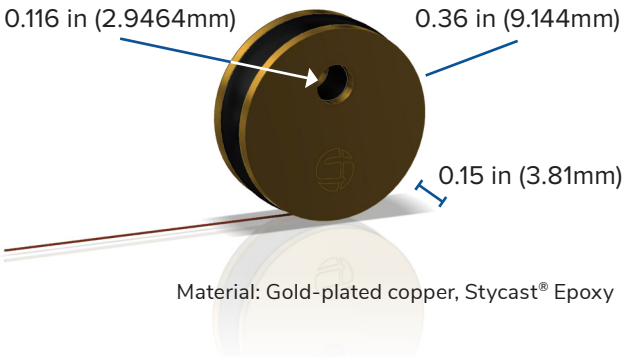


Material: Gold-plated copper, Stycast® Epoxy

Exposed Substrate



Model 22 Bobbin



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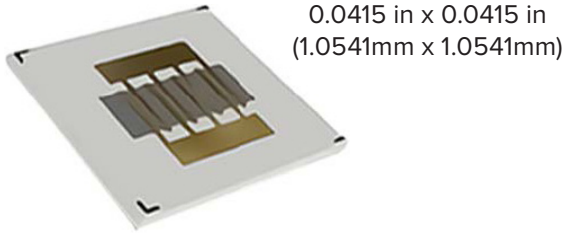
Bare Chip



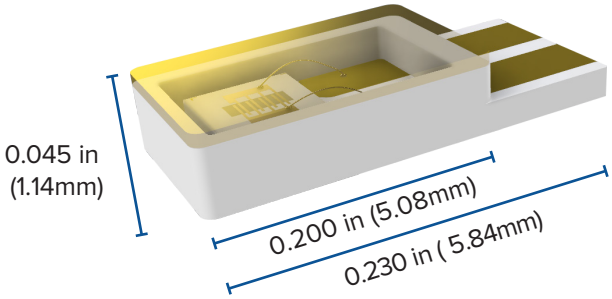
Only available in uncalibrated configuration

Four-Wire Options

* 36 AWG Copper, Twisted: Teflon
* 36 AWG Phosphor-Bronze, Bonded Insulation: Polyimide
* 30 AWG Phosphor-Bronze, Bonded Insulation: Polyimide
* 30 AWG Copper, Twisted (Model 25 Only) Insulation: Teflon
* 32 AWG Phosphor-Bronze, Bonded Insulation: Polyimide

*Two-Wire Configurations Available Upon Request

MH (Micro-Hermetic) Package



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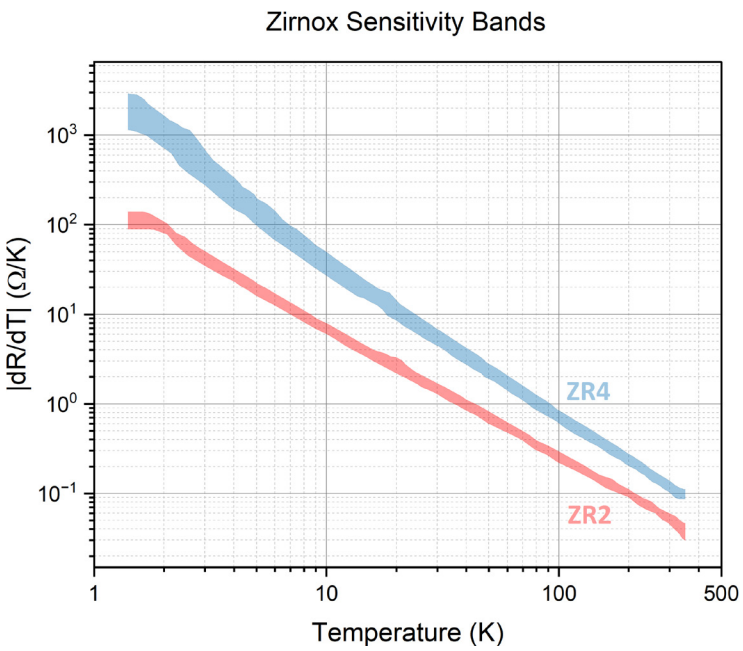
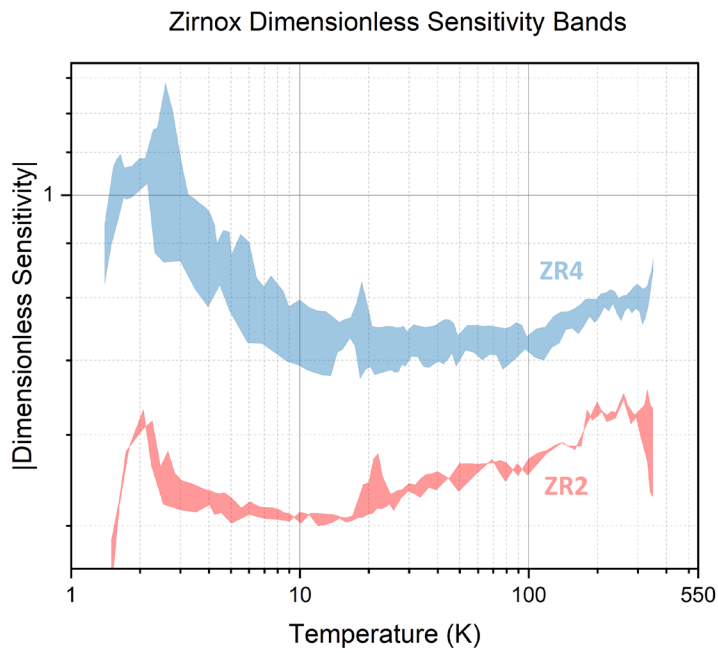




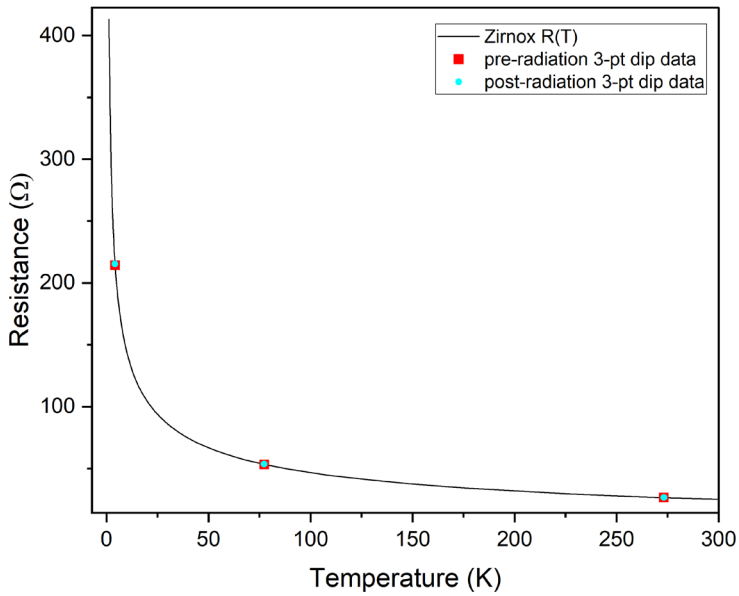
Zirnox Magnetic Field-Dependent Temperature Deviations

T(K)	2T (%)	5T (%)	10T (%)	14T (%)
0.6	-14.28	-30.43	-50	
1	-1.01	-10.98	-25	
2	-0.150	-0.479	-2.103	-4.697
4	0.066	-0.310	0.380	1.500
9	-0.020	0.249	0.614	1.165
19	0.030	0.108	0.550	1.057
30	0.040	0.132	0.621	0.980
80	-0.091	-0.122	-0.122	-0.150
200	0.046	-0.118	-0.214	-0.254
280	0.021	-0.027	-0.100	-0.186

Percent Error Equation Used In Table:

$$100\% \times \frac{T_B - T_0}{T_0}$$

where T_0 is the temperature at zero applied field, and T_B is the temperature at the given applied field



Zirnox temperature shift due to neutron and gamma irradiation, taken at ~4.2 K, ~77 K and ~273 K. The thermal neutron fluence was ~6.6E12, the fast neutron fluence (1 MeV eq. in Si) was ~1.0E12, and the total dose including gamma-rays was ~110 Gy.