

KANTHAL® A-1 RESISTANCE HEATING WIRE AND RESISTANCE WIRE

DATASHEET

Kanthal® A-1 is a ferritic iron-chromium-aluminium alloy (FeCrAl alloy) for use at temperatures up to 1400°C (2550°F). The alloy is characterized by high resistivity and very good oxidation resistance.

Typical applications for Kanthal® A-1 are electrical heating elements in high-temperature furnaces for heat treatment, ceramics, glass, steel, and electronics industries.

CHEMICAL COMPOSITION

| | C % | Si % | Mn % | Cr % | Al % | Fe % |
|----------------------|------|------|------|------|------|------|
| †Nominal composition | | | | | 5.8 | Bal. |
| Min | - | - | - | 20.5 | - | |
| Max | 0.08 | 0.7 | 0.4 | 23.5 | - | |

†Note: Composition listed is nominal. Actual composition may vary to meet standard electrical resistance and dimensional tolerances.

MECHANICAL PROPERTIES

| Wire size | Yield strength | Tensile strength | Elongation | Hardness |
|------------|-------------------|------------------|------------|----------|
| Ø | R _{p0.2} | R _m | A | |
| mm (in) | MPa (ksi) | MPa (ksi) | % | Hv |
| 1.0 (0.04) | 545 (79) | 760 (110) | 20 | 240 |
| 4.0 (0.16) | 475 (69) | 680 (99) | 18 | 230 |

MECHANICAL PROPERTIES AT ELEVATED TEMPERATURE

| Temperature °C | 900 | 1000 | 1100 | 1200 | 1300 |
|----------------|------|------|------|------|------|
| Temperature °F | 1652 | 1832 | 2012 | 2192 | 2372 |

| | | | | | |
|-----|-----|-----|-----|-----|-----|
| MPa | 34 | 18 | 10 | 6 | 4 |
| ksi | 4.9 | 2.6 | 1.5 | 0.9 | 0.6 |

Ultimate tensile strength - deformation rate 6.2×10^{-2} /min

CREEP STRENGTH - 1% ELONGATION IN 1000 H

| | | |
|----------------|------|------|
| Temperature °C | 800 | 1000 |
| Temperature °F | 1472 | 1832 |
| MPa | 1.2 | 0.5 |
| psi | 170 | 73 |

PHYSICAL PROPERTIES

| | |
|---|--------------|
| Density g/cm ³ (lb/in ³) | 7.10 (0.257) |
| Electrical resistivity at 20°C Ω mm ² /m (Ω circ. mil/ft) | 1.45 (872) |
| Poisson's ratio | 0.30 |

YOUNG'S MODULUS

| | | | | | | | |
|----------------|-----|-----|-----|-----|------|------|------|
| Temperature °C | 20 | 100 | 200 | 400 | 600 | 800 | 1000 |
| Temperature °F | 68 | 212 | 392 | 752 | 1112 | 1472 | 1832 |
| GPa | 220 | 210 | 205 | 190 | 170 | 150 | 130 |
| Msi | 32 | 30 | 30 | 28 | 25 | 22 | 19 |

TEMPERATURE FACTOR OF RESISTIVITY

| | | | | | | | | | | | | | | |
|----------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Temp. °C | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | 1000 | 1100 | 1200 | 1300 | 1400 |
| Temp. °F | 212 | 392 | 572 | 752 | 932 | 1112 | 1292 | 1472 | 1652 | 1832 | 2012 | 2192 | 2372 | 2552 |
| Ct | 1.00 | 1.00 | 1.00 | 1.00 | 1.01 | 1.02 | 1.02 | 1.03 | 1.03 | 1.04 | 1.04 | 1.04 | 1.04 | 1.05 |

COEFFICIENT OF THERMAL EXPANSION

| | |
|---------------------|--|
| Temperature °C (°F) | Thermal Expansion $\times 10^{-6}$ /K (10^{-6} /°F) |
| 20 - 250 (68-482) | 11 (6.1) |
| 20 - 500 (68-932) | 12 (6.7) |
| 20 - 750 (68-1382) | 14 (7.8) |
| 20 - 1000 (68-1832) | 15 (8.3) |

THERMAL CONDUCTIVITY

| | | | | | | |
|---|-----|------|------|------|------|------|
| Temperature °C | 50 | 600 | 800 | 1000 | 1200 | 1400 |
| Temperature °F | 122 | 1112 | 1472 | 1832 | 2192 | 2552 |
| W m ⁻¹ K ⁻¹ | 11 | 20 | 22 | 26 | 27 | 35 |
| Btu h ⁻¹ ft ⁻¹ °F ⁻¹ | 6.4 | 11.6 | 12.7 | 15.0 | 15.6 | 20.2 |

SPECIFIC HEAT CAPACITY

| | | | | | | | | |
|---------------------------------------|------|------|------|------|------|------|------|------|
| Temperature °C | 20 | 200 | 400 | 600 | 800 | 1000 | 1200 | 1400 |
| Temperature °F | 68 | 392 | 752 | 1112 | 1472 | 1832 | 2192 | 2552 |
| kJ kg ⁻¹ K ⁻¹ | 0.46 | 0.56 | 0.63 | 0.75 | 0.71 | 0.72 | 0.74 | 0.80 |
| Btu lb ⁻¹ °F ⁻¹ | 0.11 | 0.13 | 0.15 | 0.18 | 0.17 | 0.17 | 0.18 | 0.19 |

| | |
|---|--|
| Melting point °C (°F) | 1500 (2732) |
| Max continuous operating temperature in air °C (°F) | 1400 (2552) |
| Magnetic properties | The material is magnetic up to approximately 600°C (1112°F) (Curie point). |
| Emissivity - fully oxidized material | 0.70 |

Disclaimer: Recommendations are for guidance only, and the suitability of a material for a specific application can be confirmed only when we know the actual service conditions. Continuous development may necessitate changes in technical data without notice. This datasheet is only valid for materials under the trademark Kanthal®.