

## Haynes 230® alloy, 10% cold reduction

Category : Metal , Nonferrous Metal , Nickel Alloy , Superalloy

### Material Notes:

Excellent high-temperature strength, outstanding resistance to oxidizing environments up to 1149°C, premier resistance to nitriding environments, and excellent long-term thermal stability. Applications include combustion cans, transition ducts, flameholders, thermocouple sheaths and other gas turbine components; used for catalyst grid supports in ammonia burners, high-strength thermocouple protection tubes, high-temperature heat exchangers, ducts, high-temperature bellows; furnace retorts, chains and fixtures, burner flame shrouds, recuperator internals, dampers, nitriding furnace internals, heat-treating baskets, grates, trays, sparger tubes, and cyclone internals. Data provided by the manufacturer, Haynes International, Inc.

Order this product through the following link:

[http://www.lookpolymers.com/polymer\\_Haynes-230-alloy-10-cold-reduction.php](http://www.lookpolymers.com/polymer_Haynes-230-alloy-10-cold-reduction.php)

| Physical Properties | Metric    | English                  | Comments |
|---------------------|-----------|--------------------------|----------|
| Density             | 8.97 g/cc | 0.324 lb/in <sup>3</sup> | at RT    |

| Mechanical Properties      | Metric                          | English                           | Comments   |
|----------------------------|---------------------------------|-----------------------------------|------------|
| Tensile Strength, Ultimate | 995 MPa                         | 144000 psi                        |            |
| Tensile Strength, Yield    | 715 MPa<br>@Strain 0.200 %      | 104000 psi<br>@Strain 0.200 %     |            |
| Elongation at Break        | 31.8 %                          | 31.8 %                            | in 50.8 mm |
| Modulus of Elasticity      | 211 GPa                         | 30600 ksi                         | RT         |
|                            | 150 GPa<br>@Temperature 1000 °C | 21800 ksi<br>@Temperature 1830 °F |            |
|                            | 157 GPa<br>@Temperature 900 °C  | 22800 ksi<br>@Temperature 1650 °F |            |
|                            | 164 GPa<br>@Temperature 800 °C  | 23800 ksi<br>@Temperature 1470 °F |            |
|                            | 171 GPa<br>@Temperature 700 °C  | 24800 ksi<br>@Temperature 1290 °F |            |
|                            | 177 GPa<br>@Temperature 600 °C  | 25700 ksi<br>@Temperature 1110 °F |            |

| Mechanical Properties | Metric               | English              | Comments |
|-----------------------|----------------------|----------------------|----------|
|                       | 184 GPa              | 26700 ksi            |          |
|                       | @Temperature 500 Â°C | @Temperature 932 Â°F |          |
|                       | 190 GPa              | 27600 ksi            |          |
|                       | @Temperature 400 Â°C | @Temperature 752 Â°F |          |
|                       | 196 GPa              | 28400 ksi            |          |
|                       | @Temperature 300 Â°C | @Temperature 572 Â°F |          |
|                       | 202 GPa              | 29300 ksi            |          |
|                       | @Temperature 200 Â°C | @Temperature 392 Â°F |          |
|                       | 207 GPa              | 30000 ksi            |          |
|                       | @Temperature 100 Â°C | @Temperature 212 Â°F |          |

| Thermal Properties | Metric                      | English                      | Comments |
|--------------------|-----------------------------|------------------------------|----------|
| CTE, linear        | 12.7 Âµm/m-Â°C              | 7.06 Âµin/in-Â°F             |          |
|                    | @Temperature 25.0 - 100 Â°C | @Temperature 77.0 - 212 Â°F  |          |
|                    | 13.0 Âµm/m-Â°C              | 7.22 Âµin/in-Â°F             |          |
|                    | @Temperature 25.0 - 200 Â°C | @Temperature 77.0 - 392 Â°F  |          |
|                    | 13.3 Âµm/m-Â°C              | 7.39 Âµin/in-Â°F             |          |
|                    | @Temperature 25.0 - 300 Â°C | @Temperature 77.0 - 572 Â°F  |          |
|                    | 13.7 Âµm/m-Â°C              | 7.61 Âµin/in-Â°F             |          |
|                    | @Temperature 25.0 - 400 Â°C | @Temperature 77.0 - 752 Â°F  |          |
|                    | 14.0 Âµm/m-Â°C              | 7.78 Âµin/in-Â°F             |          |
|                    | @Temperature 25.0 - 500 Â°C | @Temperature 77.0 - 932 Â°F  |          |
|                    | 14.4 Âµm/m-Â°C              | 8.00 Âµin/in-Â°F             |          |
|                    | @Temperature 25.0 - 600 Â°C | @Temperature 77.0 - 1110 Â°F |          |
|                    | 14.8 Âµm/m-Â°C              | 8.22 Âµin/in-Â°F             |          |
|                    | @Temperature 25.0 - 700 Â°C | @Temperature 77.0 - 1290 Â°F |          |
|                    | 15.2 Âµm/m-Â°C              | 8.44 Âµin/in-Â°F             |          |
|                    | @Temperature 25.0 - 800 Â°C | @Temperature 77.0 - 1470 Â°F |          |

| Thermal Properties     | Metric $\mu\text{m}/\text{m}\cdot\text{Å}^\circ\text{C}$ | English $\text{in}/\text{in}\cdot\text{Å}^\circ\text{F}$   | Comments |
|------------------------|--|--|----------|
|                        | @Temperature 25.0 - 900 Å°C                              | @Temperature 77.0 - 1650 Å°F                               |          |
|                        | 16.1 Å $\mu\text{m}/\text{m}\cdot\text{Å}^\circ\text{C}$ | 8.94 Å $\mu\text{in}/\text{in}\cdot\text{Å}^\circ\text{F}$ |          |
|                        | @Temperature 25.0 - 1000 Å°C                             | @Temperature 77.0 - 1830 Å°F                               |          |
| Specific Heat Capacity | 0.397 J/g-Å°C  | 0.0949 BTU/lb-Å°F  | RT       |
|                        | 0.419 J/g-Å°C  | 0.100 BTU/lb-Å°F   |          |
|                        | @Temperature 100 Å°C                                     | @Temperature 212 Å°F                                       |          |
|                        | 0.435 J/g-Å°C  | 0.104 BTU/lb-Å°F   |          |
|                        | @Temperature 200 Å°C                                     | @Temperature 392 Å°F                                       |          |
|                        | 0.448 J/g-Å°C  | 0.107 BTU/lb-Å°F   |          |
|                        | @Temperature 300 Å°C                                     | @Temperature 572 Å°F                                       |          |
|                        | 0.465 J/g-Å°C  | 0.111 BTU/lb-Å°F   |          |
|                        | @Temperature 400 Å°C                                     | @Temperature 752 Å°F                                       |          |
|                        | 0.473 J/g-Å°C  | 0.113 BTU/lb-Å°F   |          |
|                        | @Temperature 500 Å°C                                     | @Temperature 932 Å°F                                       |          |
|                        | 0.486 J/g-Å°C  | 0.116 BTU/lb-Å°F   |          |
|                        | @Temperature 600 Å°C                                     | @Temperature 1110 Å°F                                      |          |
|                        | 0.574 J/g-Å°C  | 0.137 BTU/lb-Å°F   |          |
|                        | @Temperature 700 Å°C                                     | @Temperature 1290 Å°F                                      |          |
|                        | 0.595 J/g-Å°C  | 0.142 BTU/lb-Å°F   |          |
|                        | @Temperature 800 Å°C                                     | @Temperature 1470 Å°F                                      |          |
|                        | 0.609 J/g-Å°C  | 0.146 BTU/lb-Å°F   |          |
|                        | @Temperature 900 Å°C                                     | @Temperature 1650 Å°F                                      |          |
|                        | 0.617 J/g-Å°C  | 0.147 BTU/lb-Å°F   |          |
|                        | @Temperature 1000 Å°C                                    | @Temperature 1830 Å°F                                      |          |
| Thermal Conductivity   | 8.90 W/m-K   | 61.8 BTU-in/hr-ftÅ²-Å°F                                    | RT       |
|                        | 10.4 W/m-K   | 72.2 BTU-in/hr-ftÅ²-Å°F                                    |          |

| Thermal Properties | Metric                              | English   | Comments |
|--------------------|-------------------------------------|---|----------|
|                    | 12.4 W/m-K<br>@Temperature 100 Â°C  | 86.1 BTU-in/hr-ftÂ²-Â°F<br>@Temperature 212 Â°F |          |
|                    | @Temperature 200 Â°C                | @Temperature 392 Â°F                            |          |
|                    | 14.4 W/m-K<br>@Temperature 300 Â°C  | 99.9 BTU-in/hr-ftÂ²-Â°F<br>@Temperature 572 Â°F |          |
|                    | 16.4 W/m-K<br>@Temperature 400 Â°C  | 114 BTU-in/hr-ftÂ²-Â°F<br>@Temperature 752 Â°F  |          |
|                    | 18.4 W/m-K<br>@Temperature 500 Â°C  | 128 BTU-in/hr-ftÂ²-Â°F<br>@Temperature 932 Â°F  |          |
|                    | 20.4 W/m-K<br>@Temperature 600 Â°C  | 142 BTU-in/hr-ftÂ²-Â°F<br>@Temperature 1110 Â°F |          |
|                    | 22.4 W/m-K<br>@Temperature 700 Â°C  | 155 BTU-in/hr-ftÂ²-Â°F<br>@Temperature 1290 Â°F |          |
|                    | 24.4 W/m-K<br>@Temperature 800 Â°C  | 169 BTU-in/hr-ftÂ²-Â°F<br>@Temperature 1470 Â°F |          |
|                    | 26.4 W/m-K<br>@Temperature 900 Â°C  | 183 BTU-in/hr-ftÂ²-Â°F<br>@Temperature 1650 Â°F |          |
|                    | 28.4 W/m-K<br>@Temperature 1000 Â°C | 197 BTU-in/hr-ftÂ²-Â°F<br>@Temperature 1830 Â°F |          |
| Melting Point      | 1301 - 1371 Â°C                     | 2374 - 2500 Â°F                                 |          |
| Solidus            | 1301 Â°C                            | 2374 Â°F  |          |
| Liquidus           | 1371 Â°C                            | 2500 Â°F  |          |

| Component Elements Properties | Metric     | English    | Comments |
|-------------------------------|------------|------------|----------|
| Aluminum, Al                  | 0.30 %     | 0.30 %     |          |
| Boron, B                      | <= 0.015 % | <= 0.015 % |          |
| Carbon, C                     | 0.10 %     | 0.10 %     |          |

| Chromium, Cr<br>Component Elements Properties | 22 %<br>Metric | 22 %<br>English | Comments |
|---|----------------|-----------------|----------|
| Cobalt, Co                                    | <= 5.0 %       | <= 5.0 %        |          |
| Iron, Fe                                      | <= 3.0 %       | <= 3.0 %        |          |
| Lanthanum, La                                 | 0.020 %        | 0.020 %         |          |
| Manganese, Mn                                 | 0.50 %         | 0.50 %          |          |

| Electrical Properties  | Metric                   | English                  | Comments |
|------------------------|--------------------------|--------------------------|----------|
| Electrical Resistivity | 0.000125 ohm-cm          | 0.000125 ohm-cm          | RT       |
|                        | 0.000125 ohm-cm          | 0.000125 ohm-cm          |          |
|                        | @Temperature 1000<br>Â°C | @Temperature 1830<br>Â°F |          |
|                        | 0.0001258 ohm-cm         | 0.0001258 ohm-cm         |          |
|                        | @Temperature 100 Â°C     | @Temperature 212 Â°F     |          |
|                        | 0.0001265 ohm-cm         | 0.0001265 ohm-cm         |          |
|                        | @Temperature 200 Â°C     | @Temperature 392 Â°F     |          |
|                        | 0.0001271 ohm-cm         | 0.0001271 ohm-cm         |          |
|                        | @Temperature 900 Â°C     | @Temperature 1650<br>Â°F |          |
|                        | 0.0001273 ohm-cm         | 0.0001273 ohm-cm         |          |
|                        | @Temperature 300 Â°C     | @Temperature 572 Â°F     |          |
|                        | 0.0001284 ohm-cm         | 0.0001284 ohm-cm         |          |
|                        | @Temperature 400 Â°C     | @Temperature 752 Â°F     |          |
|                        | 0.0001291 ohm-cm         | 0.0001291 ohm-cm         |          |
|                        | @Temperature 800 Â°C     | @Temperature 1470<br>Â°F |          |
|                        | 0.0001302 ohm-cm         | 0.0001302 ohm-cm         |          |
|                        | @Temperature 500 Â°C     | @Temperature 932 Â°F     |          |
|                        | 0.0001307 ohm-cm         | 0.0001307 ohm-cm         |          |
|                        | @Temperature 700 Â°C     | @Temperature 1290<br>Â°F |          |
|                        | 0.0001312 ohm-cm         | 0.0001312 ohm-cm         |          |
|                        | @Temperature 600 Â°C     | @Temperature 1110<br>Â°F |          |

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