

## Haynes 230® alloy, plate, 16000 hours exposure at 760°C (1400°F)

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-plate-16000-hours-exposure-at-760C-1400F.php](http://www.lookpolymers.com/polymer_Haynes-230-alloy-plate-16000-hours-exposure-at-760C-1400F.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 | 910 MPa                         | 132000 psi                        |            |
| Tensile Strength, Yield    | 420 MPa<br>@Strain 0.200 %      | 60900 psi<br>@Strain 0.200 %      |            |
| Elongation at Break        | 33 %                            | 33 %                              | 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 |            |
|                            | 184 GPa<br>@Temperature 500 °C  | 26700 ksi<br>@Temperature 932 °F  |            |

| Mechanical Properties | 196 GPa<br>Metric   | 27600 ksi<br>English | Comments |
|-----------------------|---------------------|----------------------|----------|
|                       | @Temperature 400 °C | @Temperature 752 °F  |          |
|                       | 196 GPa             | 28400 ksi            |          |
|                       | @Temperature 300 °C | @Temperature 572 °F  |          |
|                       | 202 GPa             | 29300 ksi            |          |
|                       | @Temperature 200 °C | @Temperature 392 °F  |          |
|                       | 207 GPa             | 30000 ksi            |          |
|                       | @Temperature 100 °C | @Temperature 212 °F  |          |
| Charpy Impact         | 26.0 J              | 19.2 ft-lb           |          |

| Thermal Properties | Metric                                    | English                                     | Comments |
|--------------------|---|---|----------|
| CTE, linear        | 12.7 $\mu\text{m}/\text{m}\cdot\text{°C}$ | 7.06 $\mu\text{in}/\text{in}\cdot\text{°F}$ |          |
|                    | @Temperature 25.0 - 100 °C                | @Temperature 77.0 - 212 °F                  |          |
|                    | 13.0 $\mu\text{m}/\text{m}\cdot\text{°C}$ | 7.22 $\mu\text{in}/\text{in}\cdot\text{°F}$ |          |
|                    | @Temperature 25.0 - 200 °C                | @Temperature 77.0 - 392 °F                  |          |
|                    | 13.3 $\mu\text{m}/\text{m}\cdot\text{°C}$ | 7.39 $\mu\text{in}/\text{in}\cdot\text{°F}$ |          |
|                    | @Temperature 25.0 - 300 °C                | @Temperature 77.0 - 572 °F                  |          |
|                    | 13.7 $\mu\text{m}/\text{m}\cdot\text{°C}$ | 7.61 $\mu\text{in}/\text{in}\cdot\text{°F}$ |          |
|                    | @Temperature 25.0 - 400 °C                | @Temperature 77.0 - 752 °F                  |          |
|                    | 14.0 $\mu\text{m}/\text{m}\cdot\text{°C}$ | 7.78 $\mu\text{in}/\text{in}\cdot\text{°F}$ |          |
|                    | @Temperature 25.0 - 500 °C                | @Temperature 77.0 - 932 °F                  |          |
|                    | 14.4 $\mu\text{m}/\text{m}\cdot\text{°C}$ | 8.00 $\mu\text{in}/\text{in}\cdot\text{°F}$ |          |
|                    | @Temperature 25.0 - 600 °C                | @Temperature 77.0 - 1110 °F                 |          |
|                    | 14.8 $\mu\text{m}/\text{m}\cdot\text{°C}$ | 8.22 $\mu\text{in}/\text{in}\cdot\text{°F}$ |          |
|                    | @Temperature 25.0 - 700 °C                | @Temperature 77.0 - 1290 °F                 |          |
|                    | 15.2 $\mu\text{m}/\text{m}\cdot\text{°C}$ | 8.44 $\mu\text{in}/\text{in}\cdot\text{°F}$ |          |
|                    | @Temperature 25.0 - 800 °C                | @Temperature 77.0 - 1470 °F                 |          |
|                    | 15.7 $\mu\text{m}/\text{m}\cdot\text{°C}$ | 8.72 $\mu\text{in}/\text{in}\cdot\text{°F}$ |          |

| Thermal Properties     | Metric<br>@ Temperature 25.0 -<br>900 °C | English<br>@ Temperature 77.0 -<br>1650 °F | Comments |
|------------------------|--|--|----------|
|                        | 16.1 μm/m-°C                             | 8.94 μin/in-°F                             |          |
|                        | @Temperature 25.0 -<br>1000 °C           | @Temperature 77.0 -<br>1830 °F             |          |
| Specific Heat Capacity | 0.397 J/g-°C                             | 0.0949 BTU/lb-°F                           | RT       |
|                        | 0.419 J/g-°C                             | 0.100 BTU/lb-°F                            |          |
|                        | @Temperature 100 °C                      | @Temperature 212 °F                        |          |
|                        | 0.435 J/g-°C                             | 0.104 BTU/lb-°F                            |          |
|                        | @Temperature 200 °C                      | @Temperature 392 °F                        |          |
|                        | 0.448 J/g-°C                             | 0.107 BTU/lb-°F                            |          |
|                        | @Temperature 300 °C                      | @Temperature 572 °F                        |          |
|                        | 0.465 J/g-°C                             | 0.111 BTU/lb-°F                            |          |
|                        | @Temperature 400 °C                      | @Temperature 752 °F                        |          |
|                        | 0.473 J/g-°C                             | 0.113 BTU/lb-°F                            |          |
|                        | @Temperature 500 °C                      | @Temperature 932 °F                        |          |
|                        | 0.486 J/g-°C                             | 0.116 BTU/lb-°F                            |          |
|                        | @Temperature 600 °C                      | @Temperature 1110 °F                       |          |
|                        | 0.574 J/g-°C                             | 0.137 BTU/lb-°F                            |          |
|                        | @Temperature 700 °C                      | @Temperature 1290 °F                       |          |
|                        | 0.595 J/g-°C                             | 0.142 BTU/lb-°F                            |          |
|                        | @Temperature 800 °C                      | @Temperature 1470 °F                       |          |
|                        | 0.609 J/g-°C                             | 0.146 BTU/lb-°F                            |          |
|                        | @Temperature 900 °C                      | @Temperature 1650 °F                       |          |
|                        | 0.617 J/g-°C                             | 0.147 BTU/lb-°F                            |          |
|                        | @Temperature 1000 °C                     | @Temperature 1830 °F                       |          |
| Thermal Conductivity   | 8.90 W/m-K                               | 61.8 BTU-in/hr-ft <sup>2</sup> -°F         | RT       |
|                        | 10.4 W/m-K                               | 72.2 BTU-in/hr-ft <sup>2</sup> -°F         |          |
|                        | @Temperature 100 °C                      | @Temperature 212 °F                        |          |
|                        | 12.4 W/m-K                               | 86.1 BTU-in/hr-ft <sup>2</sup> -°F         |          |
|                        | @Temperature 200 °C                      | @Temperature 392 °F                        |          |

| Thermal Properties | Metric               | English                           | Comments |
|--------------------|----------------------|-----------------------------------|----------|
|                    | @Temperature 300 °C  | @Temperature 572 °F               |          |
|                    | 16.4 W/m-K           | 114 BTU-in/hr-ft <sup>2</sup> -°F |          |
|                    | @Temperature 400 °C  | @Temperature 752 °F               |          |
|                    | 18.4 W/m-K           | 128 BTU-in/hr-ft <sup>2</sup> -°F |          |
|                    | @Temperature 500 °C  | @Temperature 932 °F               |          |
|                    | 20.4 W/m-K           | 142 BTU-in/hr-ft <sup>2</sup> -°F |          |
|                    | @Temperature 600 °C  | @Temperature 1110 °F              |          |
|                    | 22.4 W/m-K           | 155 BTU-in/hr-ft <sup>2</sup> -°F |          |
|                    | @Temperature 700 °C  | @Temperature 1290 °F              |          |
|                    | 24.4 W/m-K           | 169 BTU-in/hr-ft <sup>2</sup> -°F |          |
|                    | @Temperature 800 °C  | @Temperature 1470 °F              |          |
|                    | 26.4 W/m-K           | 183 BTU-in/hr-ft <sup>2</sup> -°F |          |
|                    | @Temperature 900 °C  | @Temperature 1650 °F              |          |
|                    | 28.4 W/m-K           | 197 BTU-in/hr-ft <sup>2</sup> -°F |          |
|                    | @Temperature 1000 °C | @Temperature 1830 °F              |          |
| Melting Point      | 1301 - 1371 °C       | 2374 - 2500 °F                    |          |
| Solidus            | 1301 °C              | 2374 °F                           |          |
| Liquidus           | 1371 °C              | 2500 °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                  | 22 %       | 22 %       |          |
| Cobalt, Co                    | <= 5.0 %   | <= 5.0 %   |          |
| Iron, Fe                      | <= 3.0 %   | <= 3.0 %   |          |
| Lanthanum, La                 | 0.020 %    | 0.020 %    |          |

| Electrical Properties  | Metric          | English         | Comments |
|------------------------|-----------------|-----------------|----------|
| Electrical Resistivity | 0.000125 ohm-cm | 0.000125 ohm-cm | RT       |

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

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