METAL SHEATHS

To protect a temperature sensor within the process it is measuring a metal sheath can be used. There are several different metals to choose from, each have different properties to allow the best suited material to be chosen for your temperature and process.

Metal	Description	Material Number	Thermal Conductivity	Max Temperature
446 Stainless Steel	446 performs better than austenitic steels in sulphurous reducing atmospheres. In nitrogen concentrations 446 stainless steel can result in early failure. Hot gases containing hydrocarbons and carbon monoxide can cause carburisation. 446 requires oxygen to be present in order to form an oxide layer, otherwise failure occurs quickly.	1.4762	17-28 W/m °C	1100° C
Alloy 600 (Inconel)	With high nickel content, Alloy 600 is virtually immune to chloride-induced stress corrosion cracking. The alloy has superb corrosion resistance to caustic environments and resistance to dry chlorine up to 538°C. This alloy has excellent oxidation resistance up to 1093°C combined with high carburisation resistance and demonstrates good performance in high temperature nitriding environments. It is not recommended that Alloy 600 be used at red heat temperatures where sulphur is present. It has also been found that Alloy 600 can fall victim to stress corrosion cracking in hot, concentrated caustic alkalis, however, this can be avoided if the fabrication is fully stress relieved before use. Recommended stress relieving temperature of 982-1010 °C for 1 hour yields the best performance.	2.4816	18.3 W/m °C at 500°C	1100° C
Alloy 800 HT (Inconel)	Alloy 800 HT displays good resistance to high temperature corrosion with reasonable effectiveness against sulphur resistance at moderate temperatures.	1.4876	11-32 W/m °C	1100° C
316 Stainless Steel	316 SS is one of the most popular sheath material choices. It is commonly found in chemical plant temperature sensor applications. It has very similar characteristics to 321 Stainless Steel but provides better acid resistance and effective corrosion and pitting resistance.	1.4401	14.7 W/m °C	800° C
310 Stainless Steel	310 has mechanical or corrosion resistance, it is similar to but better than 304 SS. 310 has very good heat resistance. This alloy contains 25% chromium, 20% nickel.	1.4845	19 W/m °C at 500°C	1150° C
321 Stainless Steel	321 SS often used for Mineral Insulated thermocouple type J and Pt100 sensor assemblies, temperature sensor sheathing. 321 SS, also called 18/8, is corrosion resistant.	1.4541	14.7 W/m °C	800° C
253 MA	253 MA is an austenitic, chromium-nickel steel alloyed with nitrogen and rare earth metals. 253 MA has high creep strength, very good resistance to isothermal and, particularly, cyclic oxidation. It has good structural stability at high temperatures and good weldability.	1.4893	21 W/m °C at 500°C	1150°C

METAL SHEATHS

Metal	Description	Material Number	Thermal Conductivity	Max Temperature
Mild Steel	Mild steel protection sheaths are rarely used because of their low temperature limit.		Dependent on heat treatment.	550˚ C
Kanthal AF, Kanthal APM	Kanthal AF, Kanthal APM has great sulphur resistance and can resist carburisation at higher temperatures than other materials. It has better heat transfer than ceramic. Kanthal AF, Kanthal APM has excellent form stability, excellent corrosion resistance in most atmospheres and high thermal conductivity.		12-32 W/m ˚C	1400˚C
Platinum	Platinum is commonly used in glass manufacturing processes. For example, in rare metal thermocouples as a protection thimble. It is an expensive metal.		74 W/m ˚C at 20˚C	1600˚C
Platinum 10% Rhodium	This platinum alloy has good strength at higher temperatures and is an expensive metal. It is therefore used in molten glass processes and heat treatment.		31 W/m ˚C at 20˚C	1700˚C

Special Coatings

There are various special metal coatings available that can be applied to protect the sheath of the temperature sensor within the environment it will be operating within. The coating provides surface protection and is used to form a layer, which changes the surface properties. Metal coatings are used to prevent ferrous metals from corroding, erosion and or chemical attack and can also improve the appearance of all metals.

Tungsten Carbide is a popular coating used on metal sheaths of temperature sensors. A tungsten carbide coating provides wear resistance and coating integrity. A typical application would be on thermocouples used in cement plants where there is wear due to abrasion, impact resistance and sliding.

Other Sheath Materials

A temperature sensor can be manufactured with other sheath materials, for example having a ceramic sheath for protection in extreme high temperatures. If there is an alternative material you would like to use, or a maximum temperature the sensor needs to operate within, or you are unsure of the best material to use, please speak to our technical team and they will support you.