SUPER PURE NICKEL

ISABELLENHÜTTE

Brand Name	SUPER PURE NICKEL
Material Code	1)
Abbreviation	Ni 99.98

Ideal Chemical Composition (mass components) in %

Ni 99.98		

Form of Delivery

SUPER PURE NICKEL is supplied in the form of round wires in the range 3.0 to 0.10 mm Ø in bare or enamelled condition, also with rayon or silk covering, and in the form of stranded wires.

Properties and Application Notes

SUPER PURE NICKEL is especially characterized by very high temperature coefficient and low resistivity.
SUPER PURE NICKEL is used for resistors with a strongly temperature-dependent resistance value, also for the production of spark-plugs.
SUPER PURE NICKEL is magnetic up to a temperature of appr. 360 °C (the Curie point is at appr. 357.5 °C).
The maximum working temperature in air is 700 °C.

Notes on Treatment

SUPER PURE NICKEL is very soft as compared with the types of technically pure nickel quoted in DIN 17740; this must be taken into consideration when it is processed. As can be seen from the following graphs, its physical properties are heavily temperature-dependent, the latter being strongly affected if the Curie point is exceeded.

Electrical Resistance in Annealed Condition

Temperature coefficient[2] of electrical resistance between 0 °C and 100 °C 10^{-6}/K	Electrical resistivity in: µΩ x cm (first line) and Ω/CMF (second line) Reference Values 20 °C	100 °C	200 °C	300 °C	400 °C	500 °C
appr. +6600	7	11	17	24	31	35
	42	66	102	144	186	211

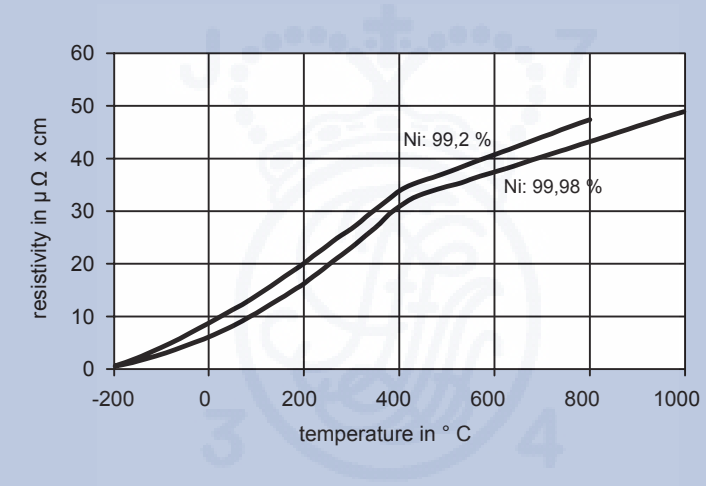
Physical Characteristics (Reference Values)

Density at 20 °C		Melting Point	Specific heat at 20 °C	Thermal conductivity[3] at 20 °C	Average linear thermal expansion coefficient between 20 °C and		Thermal EMF against copper at 20 °C
g/cm³	lb/cub in	°C	J/g K	W/m K	100 °C 10^{-6}/K	400 °C 10^{-6}/K	µV/K
8.9	0.32	1453		see special graphs			-23

Strength Properties at 20 °C in Annealed Condition

Tensile Strength[4]		Elongation (L_0 = 100 mm) % at nominal diameter in mm				
MPa	psi	0.02 to 0.063	> 0.063 to 0.125	> 0.125 to 0.5	> 0.5 to 1	> 1
> 400	> 58000	< 10	≈ 10	≈ 15	≥ 18	≥ 20

1) SUPER PURE NICKEL is not a standardized alloy.
2) These are approximate values; tolerances must separately be agreed upon.
3) As with all pure metals, the thermal conductivity strongly depends on the purity and temperature.
4) This value applies to wires of 2 mm diameter. For thinner wires the minimum values will substantially increase, depending on the dimensions.

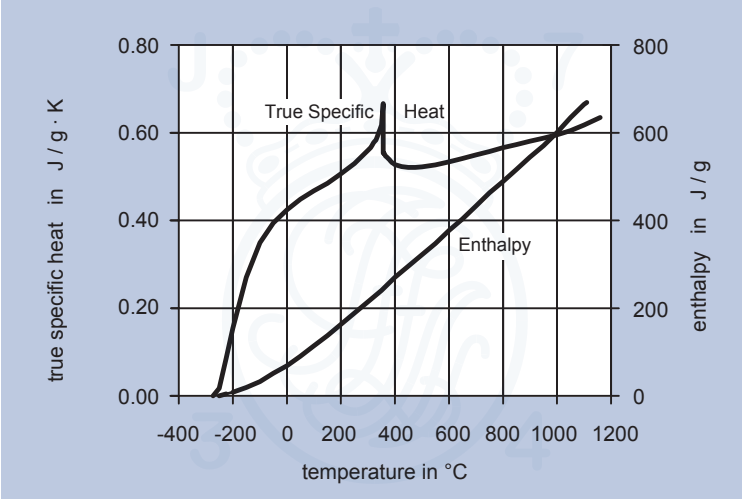


Graph 1:
Resistivity of Nickel vs. Temperature

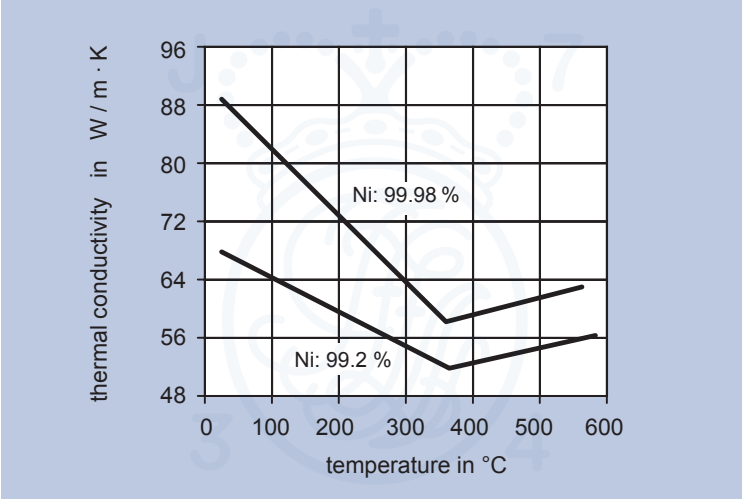
*1 ppm = 10^{-6} = 0.0001 %, 1000 ppm = $1 \cdot 10^{-3}$ = 0.1 %.

Special Remarks on the Behaviour of the Electrical Resistance vs. Temperature

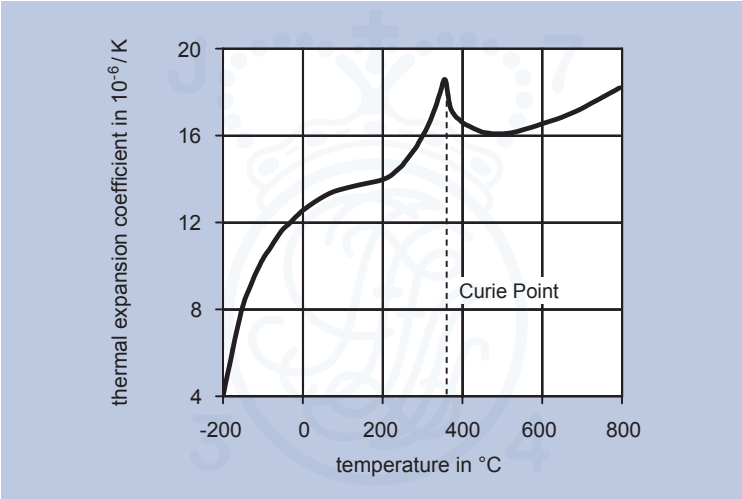
The variation of the resistivity of SUPER PURE NICKEL vs. temperature in the range between -200 °C and +1000 °C is shown in graph 1.
As can be seen, the values below the Curie point are distinctly lower than could be expected on the basic of the behaviour in the paramagnetic range above the Curie Point. Accordingly, the temperature coefficient increases from a value of 6600 ppm/K in the range between 0 °C and 100 °C to values of about 10000 ppm/K in the range between 0 °C and 357 °C and shows a distinct decrease at still higher temperatures. The ratio of the resistivity values at 1200 °C and at 20 °C is >7.



Graph 2:
Specific Heat and Enthalpy of
SUPER PURE NICKEL



Graph 3:
Thermal Conductivity of two
Nickel Types of Different Pureness



Graph 4:
Thermal Expansion Coefficient of
SUPER PURE NICKEL

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