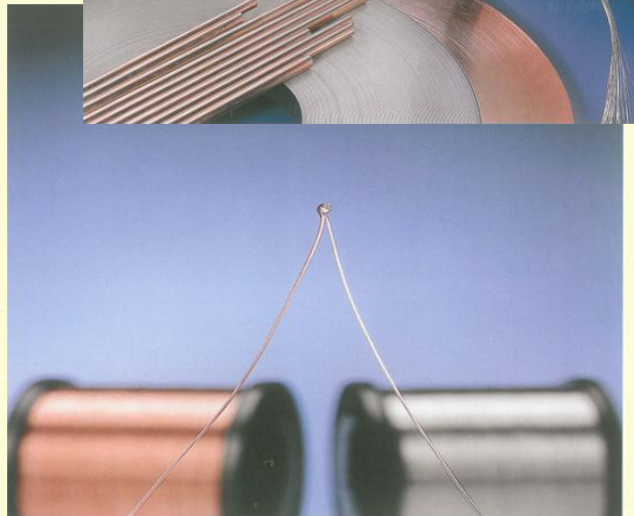
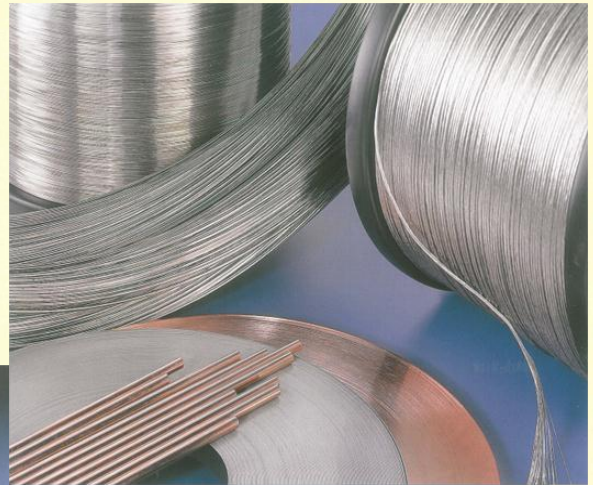
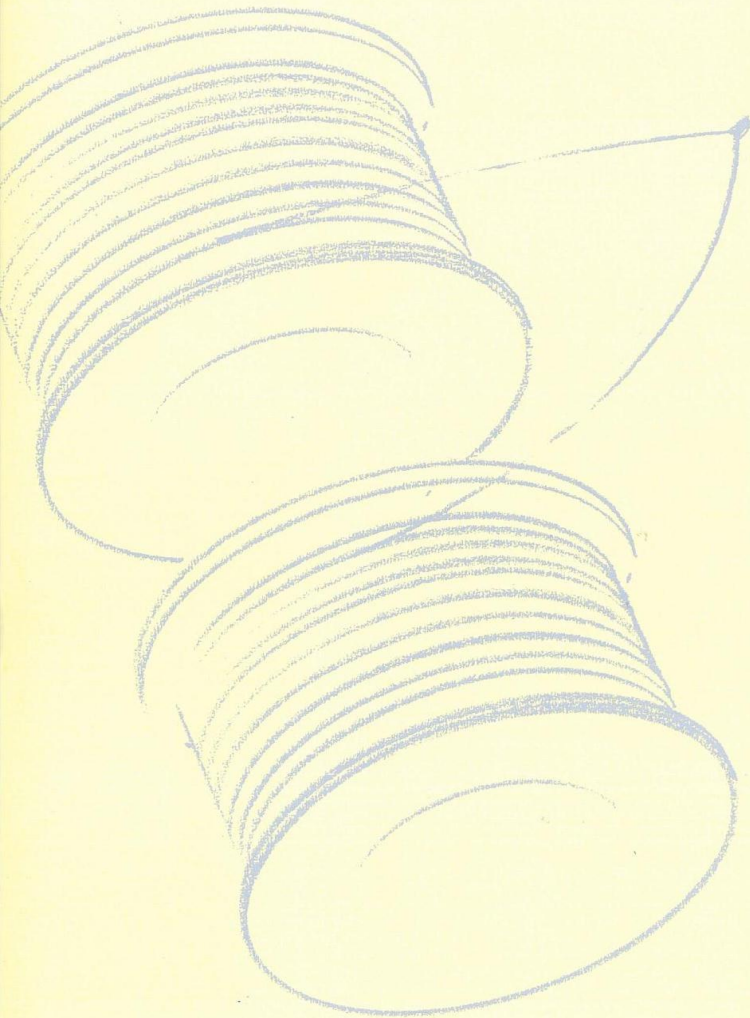




# ISABELLENHÜTTE

| Thermoelectric Alloys





# ISABELLENHÜTTE

Brand Name	<b>NICROSIL</b>		
Material Code			
Abbreviation	<b>NP (X)</b>		
Chemical Composition (mass components) in %. Average values of alloy components			
Ni	Si	Cr	
<b>Balance</b>	<b>1.3</b>	<b>14.6</b>	

## Form of Delivery

NICROSIL (NP and NPX) is supplied in the form of bare wire with dimensions from 0.10 to 6 mm Ø, coated wires from 0.10 to 1.5 mm Ø. NICROSIL is also available in the form of stranded wire, ribbon, flat wire and

rods. Please contact us for the range of dimensions.

## Features and Application Notes

NICROSIL is used as positive leg of the thermocouple N. For extension leads, NICROSIL is used for type NX. The standardized temperature range of the different application possibilities of NICROSIL is available in the tables on pages 10 and 11 as well as 14 and 15. See also "Special Remarks on the Alloy".

## Thermoelectrical and Electrical Values in Soft-Annealed Condition <sup>1)</sup>

EMF versus Cu/NIST 175 0 – 100 °C / mV	EMF versus Pt67/NIST 175 0 – 100 °C / mV	EMF versus Pt67/NIST 175 0 – 1000 °C / mV	Electrical resistivity in μΩ x cm at 20 °C
<b>1.011</b>	<b>1.785</b>	<b>26.046</b>	<b>98</b>

## Physical Characteristics (Reference Values)

Density at 20 °C	Melting point	Specific heat at 20 °C	Thermal conductivity at 20 °C	Average linear thermal expansion coefficient between 20 °C and 100 °C	Magnetic at room temperature
g/cm <sup>3</sup>	°C	J/g K	W/m K	10 <sup>-6</sup> /K	
<b>8.50</b>	<b>1394</b>	<b>0.43</b>	<b>13</b>	<b>13.1</b>	<b>no</b>

## Mechanical Properties at 20 °C in Annealed Condition <sup>2)</sup>

	Tensile strength MPa	Elongation %	Hardness HV10
<b>hard</b>	<b>&gt; 1300</b>	<b>&lt; 2</b>	<b>400</b>
<b>soft</b>	<b>760</b>	<b>25</b>	<b>160</b>

- 1) The exact EMF values according to NIST 175 can be calculated with the "EMF-Software", which can be downloaded from our homepage.  
2) The mechanical values considerably depend on dimension. The indicated values refer to a dimension of 1 mm diameter.

## Notes on Treatment

NICROSIL can be brazed without difficulty. All known welding methods are applicable. However, the alloy is difficult to soft-solder. The thermoelectric voltage of NICROSIL may change as a result of mechanical or thermal stress, see also "Special Remarks on the Alloy".

## Special Remarks on the Alloy

NICROSIL has been developed to eliminate known disadvantages with reference to the positive leg of thermocouple type K (ISATHERM PLUS®, Chromel®-P or NiCr10). An increase in the chromium concentration to approx. 14.6 % versus KP will essentially reduce the change in EMF due to the ordering state in the metal lattice. Thermoelectrically, the alloy therefore is considerably more stable against temperature changes below 600 °C. NICROSIL reacts corrosively at higher temperatures in the presence of varying oxidizing/ reducing gases. Partial oxidation of the chromium will cause green rot. Sulphur and carbon favor the development of the green rot. As a consequence, the thermoelectric voltage may change dramatically. This oxidation will also lead to brittleness of the material. An increase in silicon concentration will result in higher oxidation stability versus the positive leg of thermocouple type K.



# ISABELLENHÜTTE

## Form of Delivery

NISIL (NN und NNX) is supplied in the form of bare wire with dimensions from 0.10 to 6 mm Ø. We supply coated wires from 0.10 to 1.5 mm Ø. NISIL can also be supplied

in the form of stranded wire, ribbon, flat wire and rods. Please contact us for the range of dimensions.

Brand Name	<b>NISIL</b>		
Material Code			
Abbreviation	<b>NN (X)</b>		
Chemical Composition (mass components) in %.			
Average values of alloy components			
Ni	Si		
<b>Balance</b>	<b>4.8</b>		

## Thermoelectrical and Electrical Values in Soft-Annealed Condition <sup>1)</sup>

EMF versus Cu/NIST 175 - 0 – 100 °C / mV	EMF versus Pt67/NIST 175 0 – 100 °C / mV	EMF versus Pt67/NIST 175 0 – 1000 °C / mV	Electrical resistivity in $\mu\Omega \times \text{cm}$ at 20 °C
<b>- 1.763</b>	<b>- 0.990</b>	<b>- 10.210</b>	<b>34</b>

## Physical Characteristics (Reference Values)

Density at 20 °C	Melting point	Specific heat at 20 °C	Thermal conductivity at 20 °C	Average linear thermal expansion coefficient between 20 °C and 100 °C	Magnetic at room temperature
$\text{g/cm}^3$	°C	J/g K	W/m K	$10^{-6}/\text{K}$	
<b>8.55</b>	<b>1341</b>	<b>0.50</b>	<b>23</b>	<b>12.7</b>	<b>slight</b>

## Mechanical Properties at 20 °C in Annealed Condition <sup>2)</sup>

	Tensile strength MPa	Elongation %	Hardness HV10
<b>hard</b>	<b>&gt;1200</b>	<b>&lt; 2</b>	<b>450</b>
<b>soft</b>	<b>620</b>	<b>35</b>	<b>130</b>

1) The exact EMF values according to NIST 175 can be calculated with the "EMF-Software", which can be downloaded from our homepage.

2) The mechanical values considerably depend on dimension. The indicated values refer to a dimension of 1 mm diameter.

## Notes on Treatment

NISIL can be brazed without difficulty. All known welding methods are applicable. However, the alloy is difficult to soft-solder. See also "Special Remarks on the Alloy".

## Special Remarks on the Alloy

NISIL has been developed as a counterleg to Nicrosil. By increasing the silicon and reducing the aluminium concentration versus the negative leg of thermocouple type K (KN), a higher oxidation stability has been achieved. Consequently, compared to KN the corrosive reaction to sulphur will be lower at higher working temperatures.

## Features and Application Notes

NISIL is used as negative leg of the thermocouple type N. In the version for extension leads NISIL is used for type NNX.

The standardized temperature range of the different application possibilities of NISIL is available in the tables on pages 10 and 11 as well as 14 and 15.

See also "Special Remarks on the Alloy".

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