Schmidt + Clemens Group

Centralloy® 60 HT R

MATERIAL DATA SHEET

Designation: G-NiCr25Fe10Al

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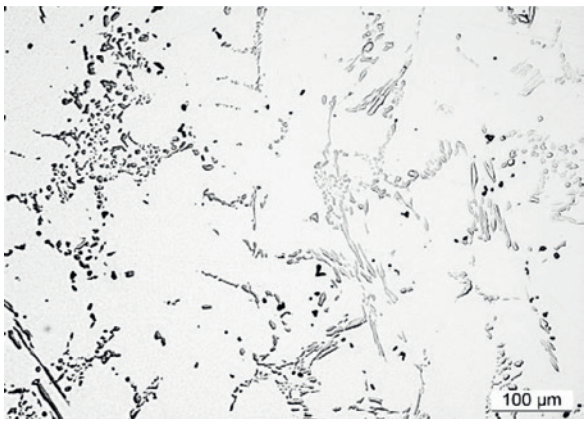
Contents

Features

Centralloy® 60 HT R is a nickel-based cast alloy containing chromium, iron, aluminium, tungsten, and niobium. The alloy shows excellent creep rupture strength. Due to the formation of an α-aluminium oxide scale, outstanding resistance in oxidizing and carburizing atmospheres is observed up to very high temperatures.

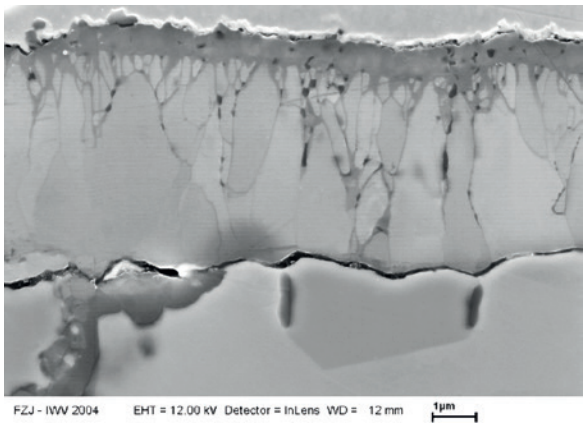
Microstructure

In the as-cast condition the microstructure of Centralloy® 60 HT R consists out of an austenitic NiCrFe matrix with primary M_7C_3 and MC carbides precipitated on the interdendritic boundaries. Within the dendrite cores extremely fine γ' precipitates (Ni_3Al) can be detected by TEM investigations. At service temperature these particles are dissolved.



Applications

Centralloy® 60 HT R may be used as furnace rollers, rotary kilns, retorts, radiant furnace tubes, combustion boats, grates, walking beams. The maximum application temperature is 1250°C.



Chemical Composition(*)

	mass percentage
Carbon	0.3 – 0.6
Chromium	24 – 30
Iron	< 10
Aluminium	3 – 5
Tungsten	< 5
Niobium	0.4 – 1
Nickel	Balance

(*) This is a typical composition which may be slightly modified

Product Forms

Centralloy® 60 HT R was designed as spun cast material to match specific design criteria in terms of creep and oxidation resistance. Besides spun cast it is also available in statically cast and investment cast product forms. Other forms may be supplied on request. Additional information regarding these topics and maximum and minimum sizes may be obtained from the sales department.

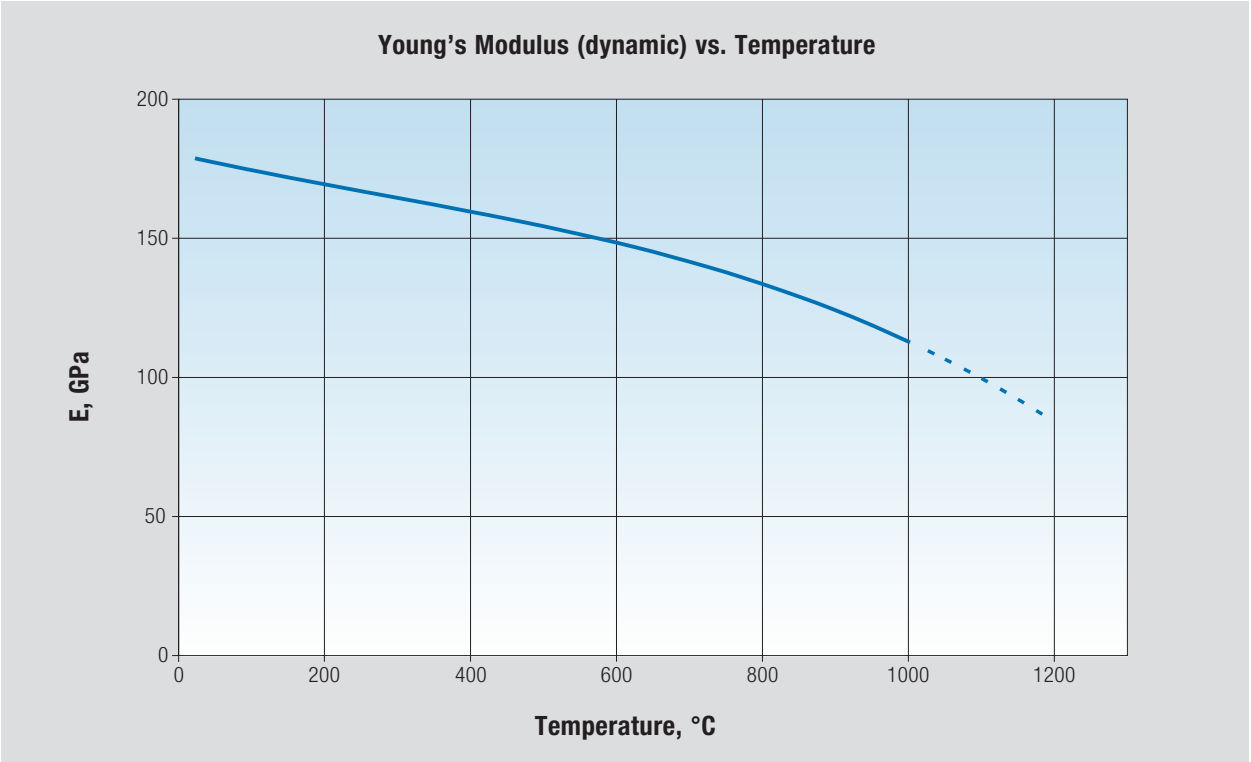
Physical Properties

Density at 20°C: 8.0 g/cm^3

Typical physical properties

δ, °C	α, 10^{-6}/K	λ, W/m K	c_p, J/kg K	E, GPa	ρ, µΩm
20	-	13.1	446	178	1.32
100	12.6	14.3	467	175	1.34
200	13.0	15.7	494	170	1.37
300	13.4	17.1	523	165	1.39
400	13.8	18.5	554	159	1.41
500	14.2	19.9	588	154	1.43
600	14.8	21.4	626	148	1.44
700	15.4	22.9	670	142	1.44
800	16.2	24.4	743*	134	1.44
900	17.4	26.2	809*	124	1.41
1000	18.5	28.2	886*	113	1.38
1100	19.2*	30*	980*	100*	1.37*

*: extrapolated
δ: Temperature
α: Mean coefficient of linear thermal expansion
λ: Thermal conductivity
c_p: Mean specific heat
E: Young's modulus (dynamic)
ρ: Electrical resistivity

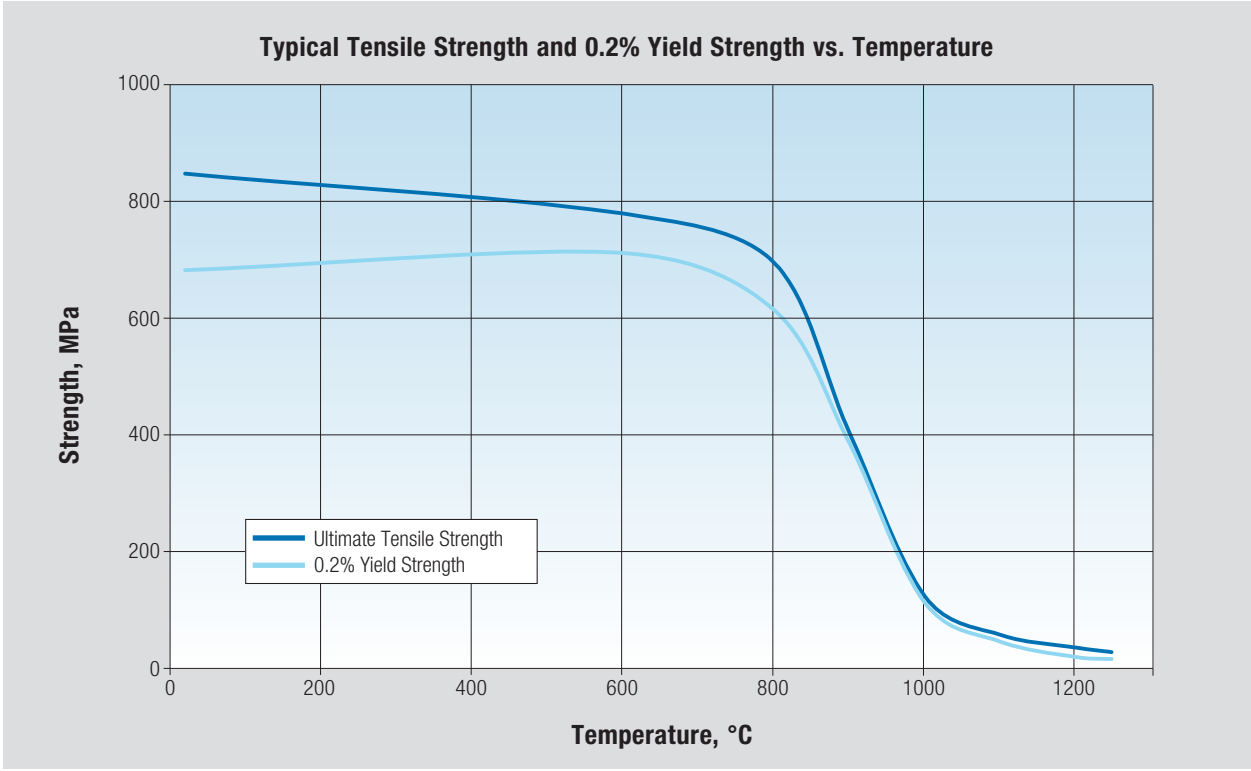


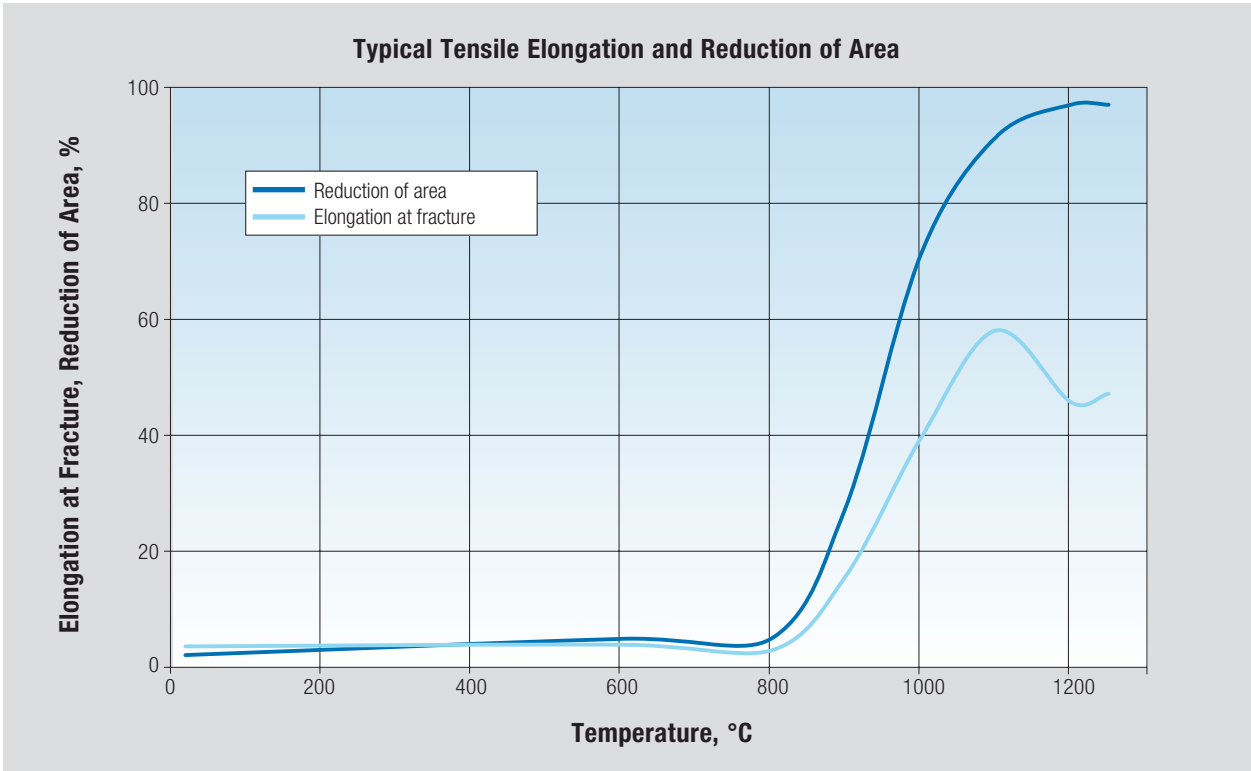
Mechanical Properties

(only for wall thickness less than 25 mm, in the as cast condition)

Tensile properties

Minimum tensile properties at 20°C:	0.2% Yield strength:	650 MPa
	Ultimate tensile strength:	800 MPa
	Elongation, (l=5d):	3%

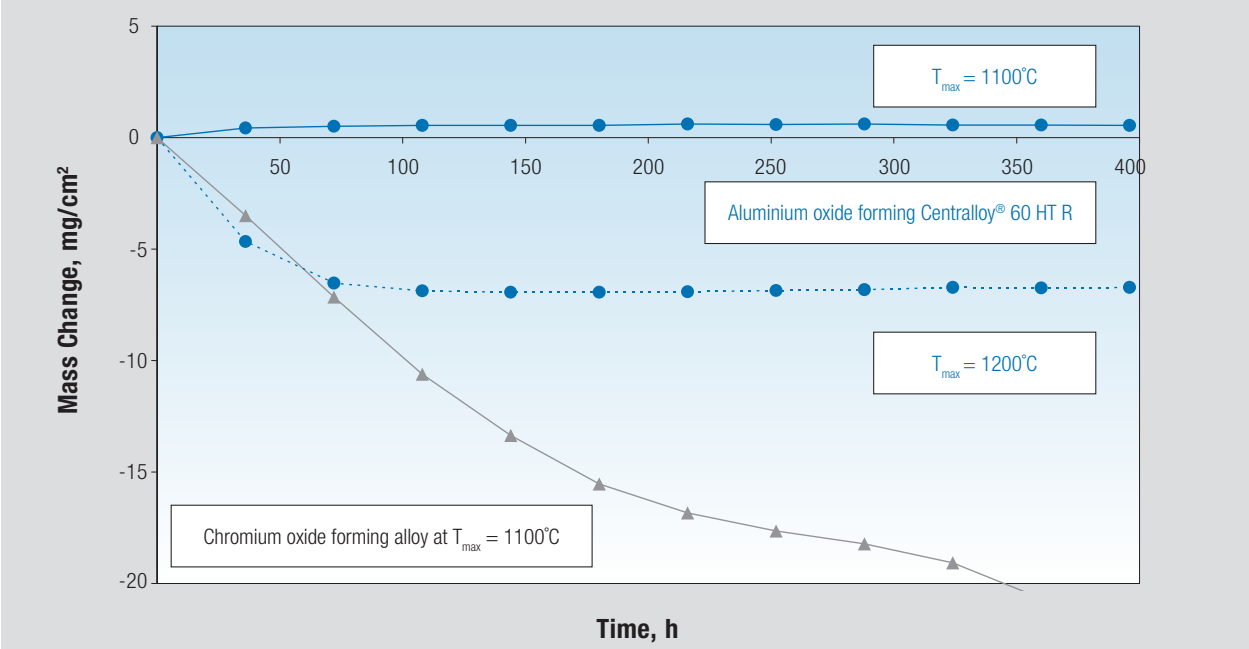




Oxidation Behaviour

Cyclic oxidation resistance

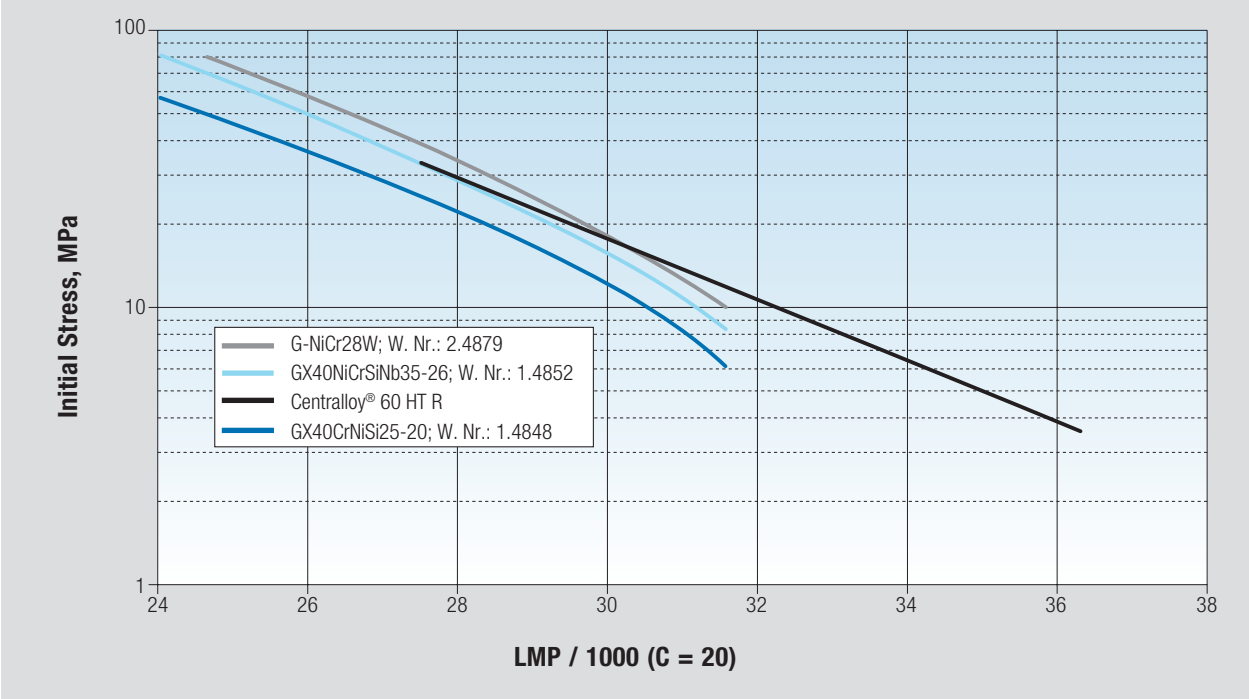
Cycle: 2 h @ T_{max} – 15 min @ 20°C
(performed by FZ Jülich)



Creep Rupture Behaviour

Comparison to heat resistant steels

Larsson-Miller-Plot



Creep Rupture Strength Data

1%-Creep Limit and Creep Rupture Strength
(Mean values of the scatter band evaluated so far)

Temperature	$R_{p1\%}$		R_m		
°C	MPa		MPa		
Time	1000 h	10000 h	1000 h	10000 h	30000 h
1000	13.3	-	21.1	15.5	-
1025	12.8	-	18.3	13.5	-
1050	12.0	-	16.0	11.7	-
1075	11.0	-	13.9	10.2	-
1100	9.8	7.8	12.1	8.8	7.6
1125	8.5	6.4	10.5	7.7	6.5
1150	7.3	5.2	9.1	6.6	5.5
1175	6.1	4.2	7.8	5.7	4.7
1200	5.0	3.4	6.6	4.8	4.2
1225	4.2	2.9	5.5	4.0	-
1250	3.7	2.6	4.4	3.2	-

Manufacturing Characteristics

Machining

Due to the very fine γ' precipitates the machinability of Centralloy® 60 HT R is harder than that of other heat resistant alloys.

Welding

Centralloy® 60 HT R should be welded preferentially by shielded metal arc welding (SMAW) processes. Depending on size and shape of the components gas tungsten arc (GTAW) and plasma arc (PAW) welding are also applicable.

Approved filler materials are bare welding rods and electrodes. Further information will be supplied upon request.

Health, Safety and Environmental Information

The operation and maintenance of welding equipment should conform to the provisions of relevant national standards for the protection of personnel and environment.

Mechanical ventilation is advisable and under certain conditions in confined spaces, it is necessary during welding operations to prevent possible exposure to hazardous fumes, gases or dust that may occur.

Nickel- and iron-base materials may contain, in varying concentrations, the elements chromium, iron, manganese, molybdenum, cobalt, nickel, tungsten and aluminium. Metal dust from welding, grinding, melting and dross handling of these alloy systems may cause adverse environmental and in case of inhalation health effects.

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Services

- Metallurgy and material engineering
- Material analysis and examinations
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- Design of tubes and tube systems
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Production sites

Germany, Spain, United Kingdom, Czech Republic, Malaysia, Saudi Arabia

Brinkmann GmbH, Die Agentur für Kommunikation, Krefeld 06/2015