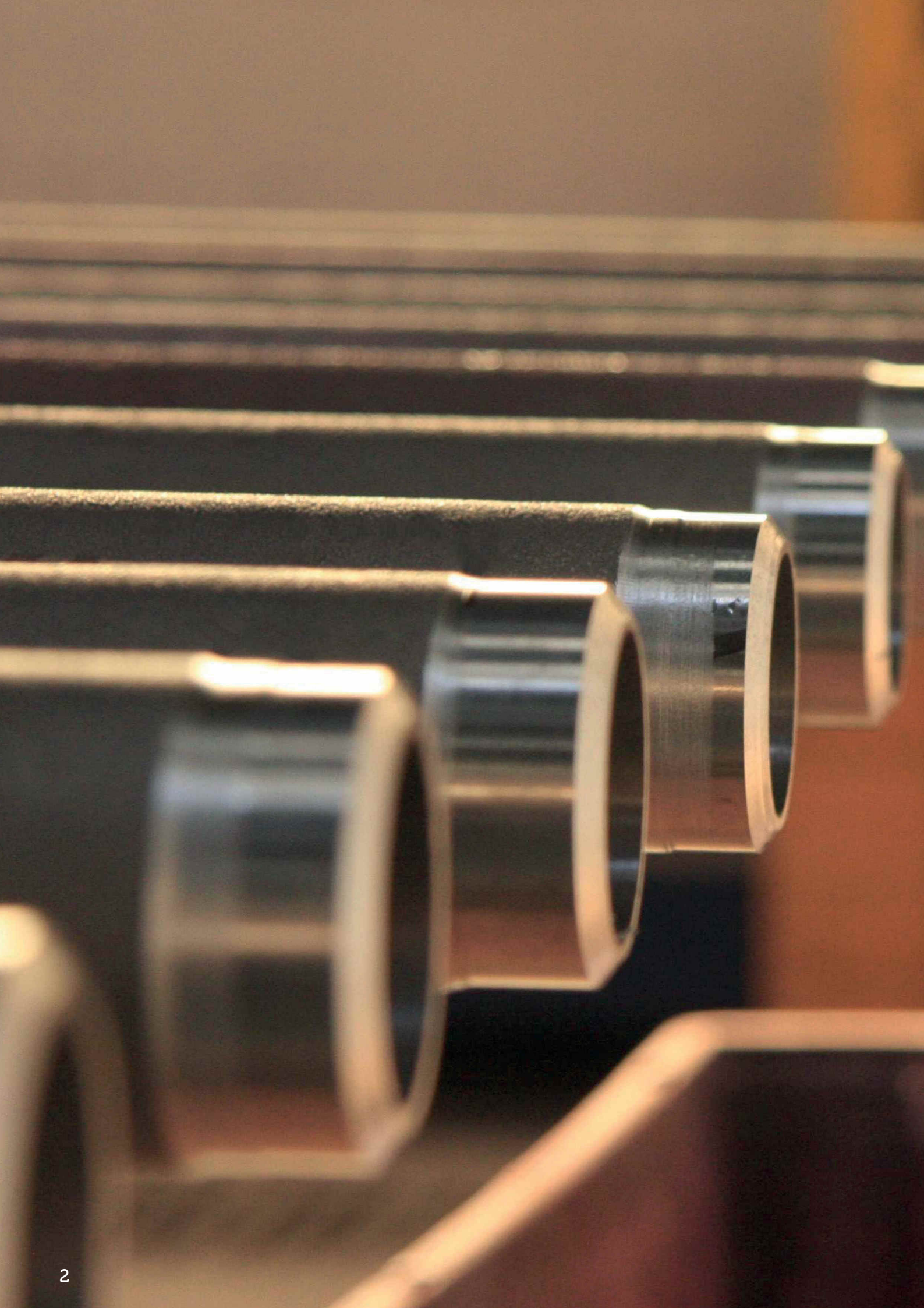


Manaurite® XTC



MANOIR
A PARALLOY GROUP COMPANY



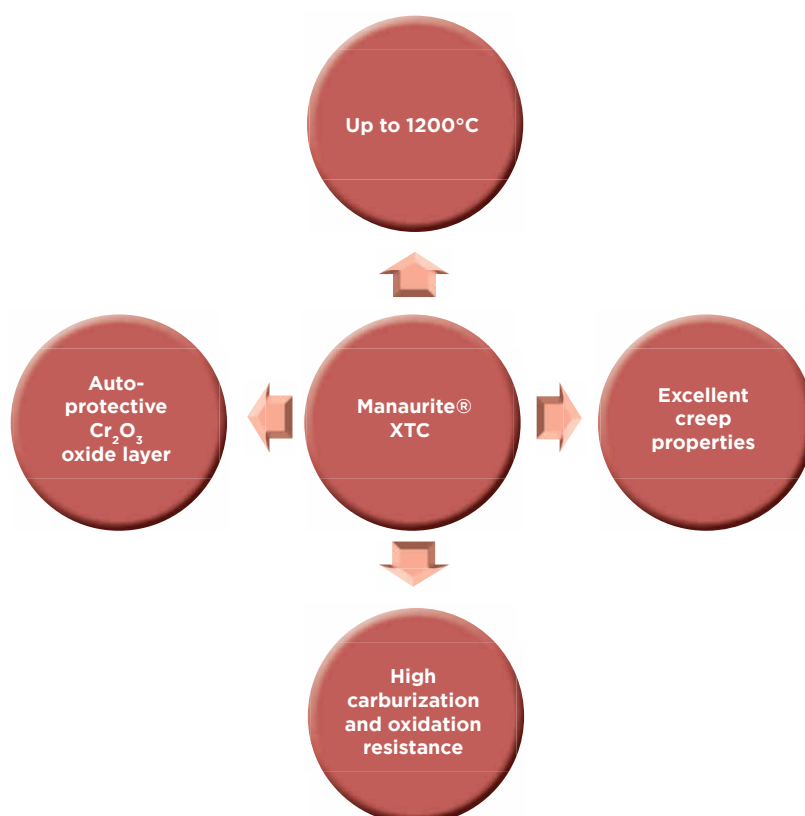
MANAURITE® XTC : HIGH CHROMIUM CONTENT AUSTENITIC STAINLESS STEEL

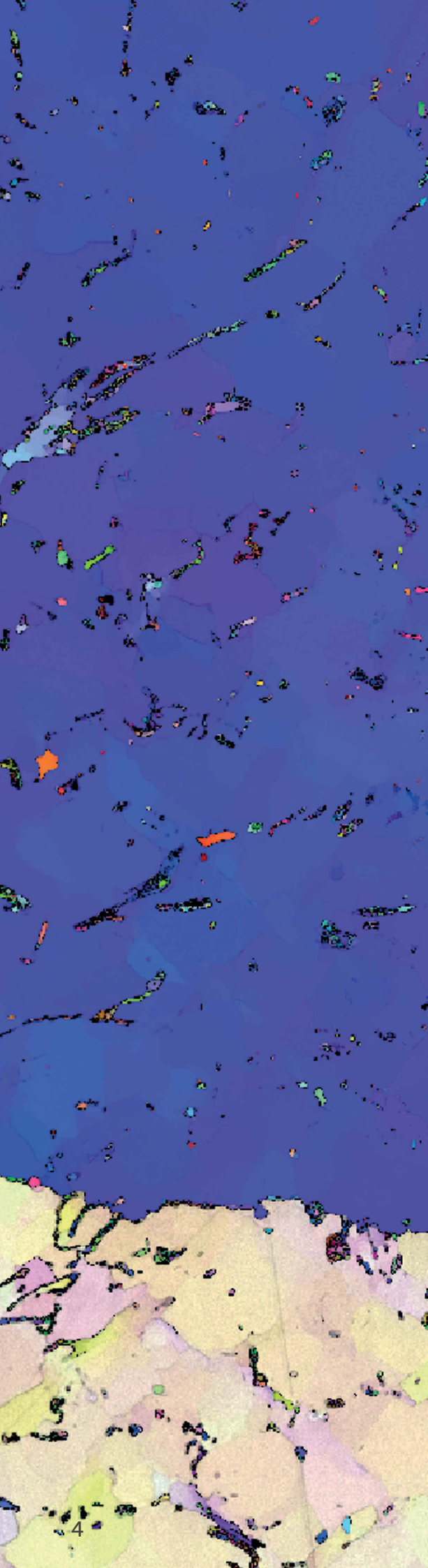
Manaurite® XTC is a nickel-based alloy developed to face coke formation and carburization issues encountered within steam-crackers for ethylene production. Its high temperature corrosion resistance, and its oxidation and mechanical properties, are the result of its high chromium content.

With its 40% chromium content, Manaurite® XTC develops a uniform and auto-protective oxide layer of chromia, with high thermal stability suitable for steam crackers service conditions. Addition elements have been finely tuned to further improve the oxidation, carburization and coking resistance of the alloy. The mechanical properties of this alloy, including creep resistance, have been carefully optimized.

Specific applications

- Radiant coils for cracking furnaces
- High severity furnaces





Chemical composition

Element	Minimum (wt%)	Maximum (wt%)
C	0.4	0,6
Mn	-	0,5
Si	-	2
Cr	40	45
Fe	8	12
Ni	Bal	Bal
Others	Add	

Physical properties

Property	Value
Density	7.9 g/cm ³
Melting point	1320 °C

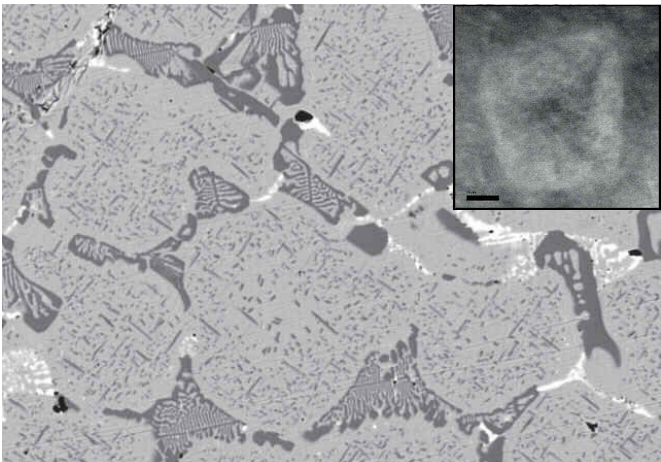
Tensile properties

	Temperature (°C)	Y.S (MPa)	U.T.S (Mpa)	E (%)
As-cast (minimum values)	20	270	470	5
	Ageing conditions	Y.S (MPa)	U.T.S (Mpa)	E (%)
After ageing room temperature (typical values)	250 h at 900 °C	460	740	5
	250 h at 1100 °C	305	600	15.4
	500 h at 900 °C	364	665	4.7
	1000 h at 1100 °C	322	533	10

Microstructure



As cast structure of Manaurite® XTC. Black particles correspond to chromium carbides and white particles correspond to niobium or titanium carbides/nitrides.



Aged structure of Manaurite® XTC (500h at 900°C). Nanometer secondary niobium carbides, precipitated in the gamma matrix (visible on the TEM cross section).

Creep properties

10 000h creep rupture stress data

Temperature (°C)	$\sigma_{\min}$ (MPa)	σ_{avg} (MPa)
800	36.6	45.7
850	29.1	36.4
900	22.5	28.2
950	16.8	21.0
1000	12.0	15.0
1050	8.0	10.1
1100	5.0	6.2
1150	2.8	3.5
1200	1.5	1.8

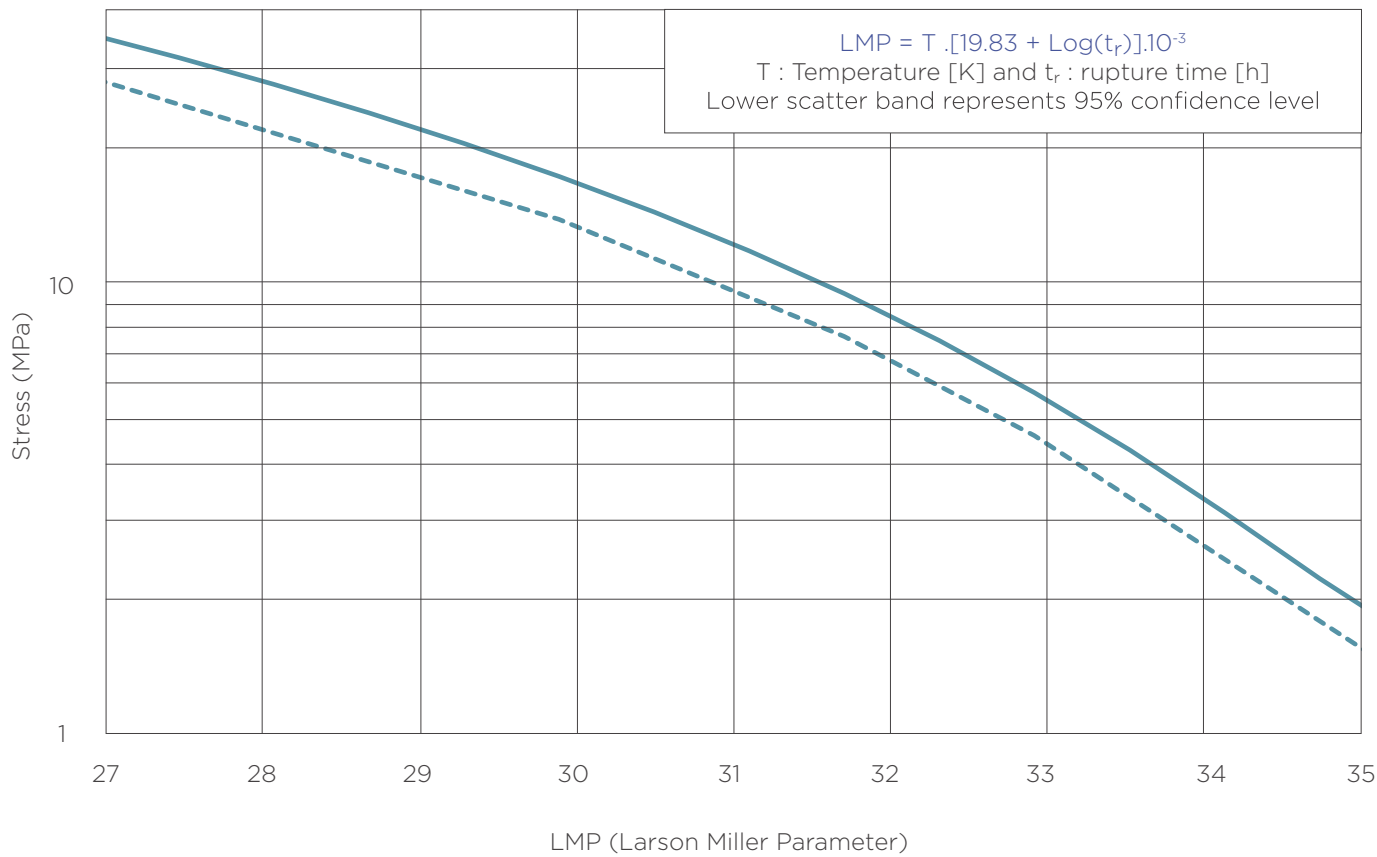
Data based on LMP extrapolation

100 000h creep rupture stress data

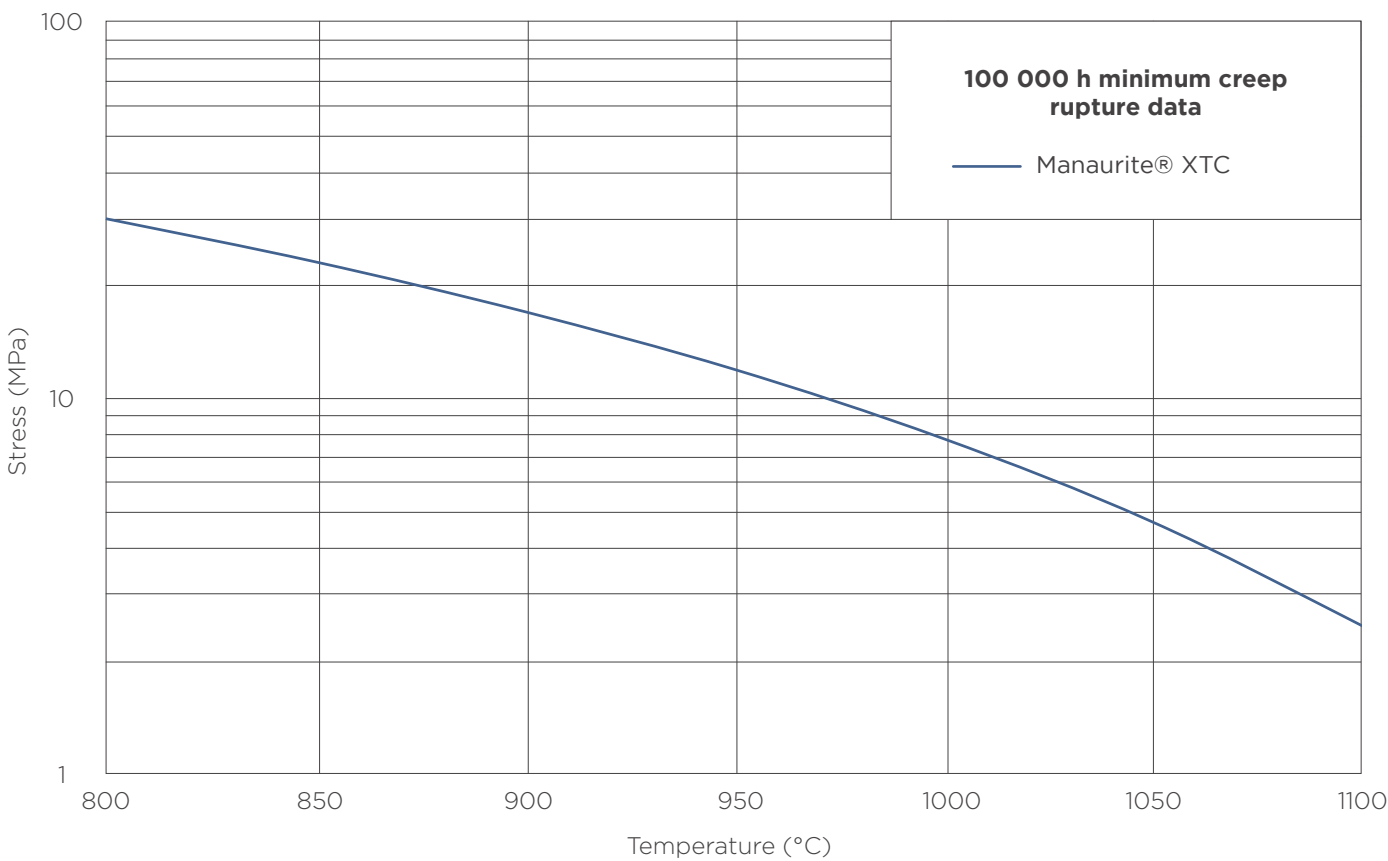
Temperature (°C)	$\sigma_{\min}$ (MPa)	σ_{avg} (MPa)
800	29.8	37.3
850	22.9	28.6
900	16.9	21.1
950	11.9	14.8
1000	7.8	9.8
1050	4.7	5.9
1100	2.5	3.1
1150	1.3	1.6
1200	1.0	1.3

Data based on LMP extrapolation

Manaurite® XTC creep rupture strength

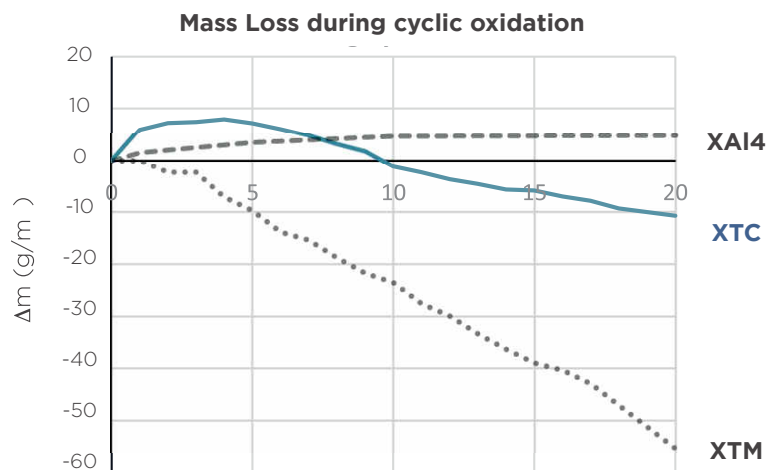
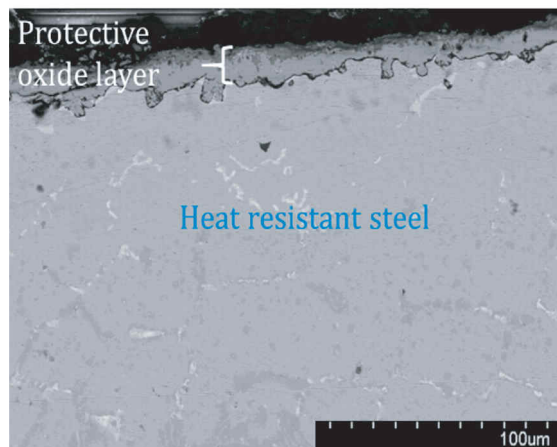


Manaurite® XTC



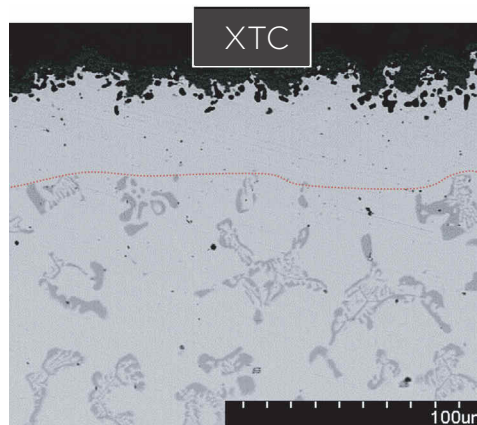
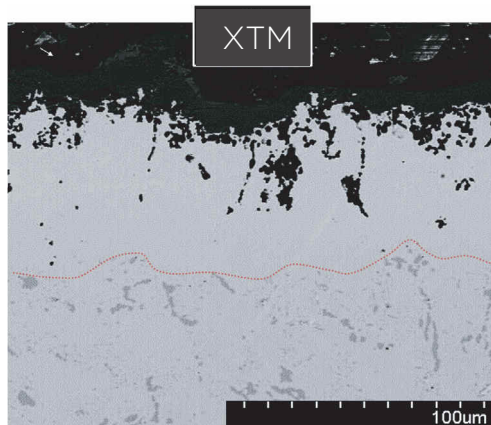
Oxidation

In oxidizing conditions, Manaurite® XTC develops a thin uniform protective chromia layer (clearly visible on the SEM cross section). This auto-protective oxide layer improves the oxidation resistance of XTC and reduces XTC's metal loss after cyclic oxidation compared to XTM.



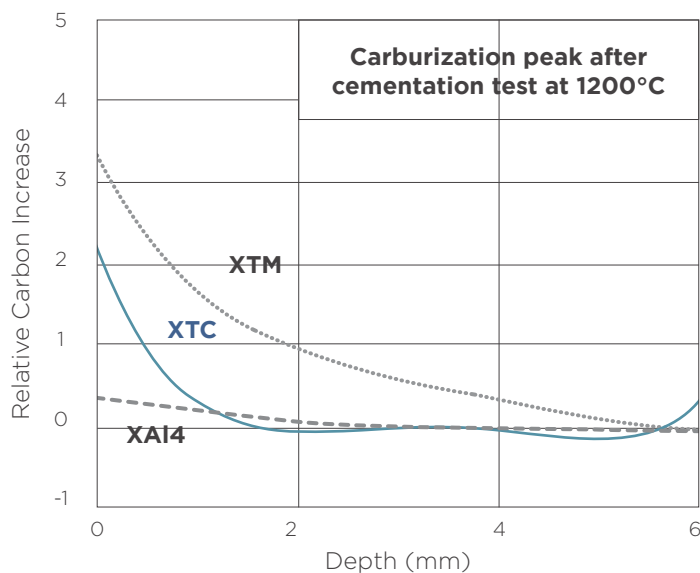
Cycles : 45 min at 1150°C / air quenched

The higher Cr content in XTC as well as addition elements help improving drastically the behavior of the protective scale. SEM cross-section examination of cycled coupons shows less internal degradation in the case of XTC.



Carburization

Manaurite® XTC, with its improved oxidation resistance, provides higher carburization resistance than Manaurite® XTM





Weldability

Further information will be supplied upon request







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