Ferro-Titanit® S

Chemical composition

Carbide phase	Binder phase (main components)			
TiC	**C**	**Cr**	**Mo**	**Fe**
32.0	0.5	19.5	2.0	Balance

(guideline values in % by weight)

Microstructure

Titanium carbide + martensite

Characteristic properties

Because of its high chromium and reduced carbon content, this grade is recommended in cases requiring elevated corrosion resistance.

Mechanical properties
hardened + tempered

Density	Compression strength	Bending fracture	Modulus of elasticity	Shear modulus	Service hardness	Further data on the mechanical properties upon request
g/cm³	**MPa**	**MPa**	**MPa**	**MPa**	**HRC**	
6.5	3700	1050	290000	116000	approx. 67	

Physical properties

Thermal expansion coefficient between 20 and 400 °C in $10^{-6} \cdot °C^{-1}$
9.7

Thermal conductivity at 20 °C in $W \cdot cm^{-1} \cdot °C^{-1}$
0.188

Measuring frequency (Hz)	Damping Q^{-1} (10^{-5})
2600	19
7100	25
22300	18

Electrical resistivity at 20 °C in $\Omega \cdot mm^2 \cdot m^{-1}$
0.77

Magnetic properties

Magnetic saturation polarisation	Coercive field strength	Remanence
mT	**kA · m⁻¹**	**mT**
620	9.8	108

Use

For parts requiring a high resistance to corrosion as well as to wear, e.g. pumps, measuring tools, thrust disks, bearings, etc.

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Annealing

Annealing °C temperature °C	Cooling	Hardness after annealing HRC	Transformation range °C
Soft 750 (10 h)	Furnace	approx. 51	800 – 850

Stress-relieving

If extensive machining is required, it is advisable, after rough-machining, i.e. before finish-machining, to stress-relief anneal at around 600 – 650 °C, followed by cooling in the furnace.

Hardening

Hardening °C temperature °C	Hardening medium	Quenching
1080	Vacuum	1 bar N_2

Heating to hardening temperature is advisably performed over several preheating stages (e.g. 400 °C, 600 °C, 800 °C) in order to ensure uniform soaking of the parts that are to be hardened and to avoid any cracking induced by thermal stress. The selected soaking time at hardening temperature must be longer than for steel tools (roughly twice to three times). Because of the rigid titanium carbide skeleton, deleterious grain growth as found in tool steel and high-speed steel cannot occur during the heat treatment. It is hence possible to accept slightly higher hardening temperatures and longer soaking times rather than insufficient hardening.

Tempering

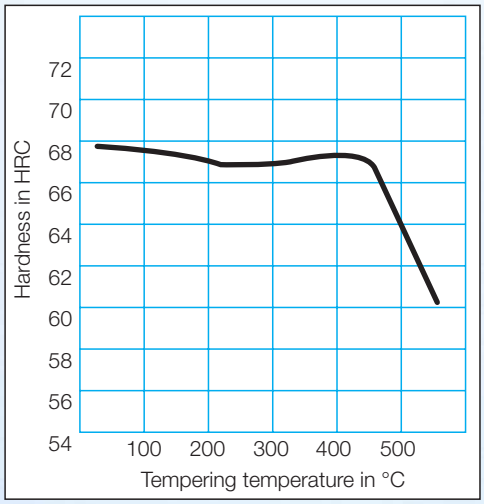
Tempering temperature °C	Service hardness HRC
180	approx. 67

In order to avoid cracking induced by hardening stresses, parts that have been hardened must be tempered immediately after quenching or cooling to around 50 °C and held at tempering temperature for at least 2 hours, followed by cooling in air.

Dimensional changes

The S grade exhibits a reduction in dimensions due to retained austenite. The dimensions are increased in this grade, however, by deep-cooling in liquid nitrogen or also repeated tempering. The change in dimensions is less than 0.1% in each case.

Tempering curve



Note
No tempering temperature other than the one indicated should be selected, as the strong, negative influence on the resistance to wear and pick-up does not justify the minor benefit of toughness improvement.