CuFe2P

C19400

STOL® 194

Industrial Rolled

Alloy Designation	STOL® 194
EN	CW107C
DIN CEN/TS 13388	CuFe2P 2.1310
UNS	C19400

High Performance STOL® Alloys

We have developed a wide range of high performance alloys with excellent properties regarding conductivity, strength, corrosion behaviour, bend ability and relaxation properties. STOL® alloys are the first choice materials for high-end applications and products.

Chemical Composition Weight percentage		
Cu	Remainder	%
Fe	2.1 .. 2 6	%
Zn	0.05 .. 0 2	%
Other	max. 0.2	%

This alloy is in accordance with RoHS 2002/96/CE for electric & electronic equipments and 2002/53/CE for automotive industry.

Characteristics

STOL®194 is a medium strength alloy, with fine Fe precipitations. It combines high conductivity with medium strength and good relaxation properties.

Main Applications

Automotive: Fuel Injectors, Electrical Connectors – Automotive

Consumer: Gift Hollow Ware

Electrical: Circuit Breaker, Components, Contact Springs, Lead Frames, Electrical Connectors, Cable Warp, Electrical

Springs: Clamps, Plug Contacts, Fuse Clips, Terminal.

Fasteners: Rivets

Industrial: Welded Condenser Tubes, Gaskets, Eyelets, Flexible Metal Hose, Stamped parts.

Preferred Applications

Spring Contact	Junction Box	Leadframes for Semiconductors	Current Carrying Capacity	Stamped Parts	Connectors
x	x	xx	xx	xx	x

x = well suited   xx = particularly well suited

Physical Properties

Typical values in annealed temper at 20 °C

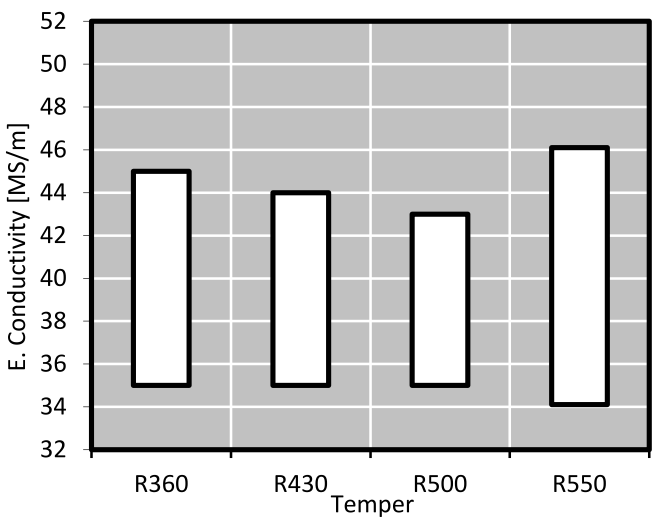
Density	8.9	g/cm³
Thermal expansion coefficient 20 .. 300 °C	16.3	10^{-6}/K
Specific heat capacity	0.38	J/(g·K)
Thermal conductivity	262	W/(m·K)
Electrical conductivity (1 MS/m = 1 m/(Ω mm²))	35	MS/m
Electrical conductivity (IACS)	60	%
Thermal coefficient of electrical resistance (0 .. 100 °C)	3.31	10^{-3}/K
Modulus of elasticity (1 GPa = 1 kN/mm²) cold formed	130	GPa
annealed	123	GPa

Mechanical Properties (EN 1652)

Temper	Tensile Strength Rm	Yield Strength Minimum $Rp_{0.2}$	Elongation Minimum A_{50mm}	Hardness HV *
	MPa	MPa	%	HV
R360	360 .. 430	270	15	110 .. 135
R430	430 .. 500	380	10	130 .. 150
R500	500 .. 550	440	7	140 .. 160
R550	≥ 550	490	4	≥ 155

*only for information

Electrical Conductivity



Electrical conductivity is strongly influenced by chemical composition. A high level of cold deformation and small grain size decrease the electrical conductivity moderately. Minimum conductivity level can be specified.

Fabrication Properties*	
Cold Forming Properties	Good
Hot Forming Properties at 800 .. 900°C	Good
Machinability (Rating 20)	Good
Electroplating Properties	Excellent
Hot Tinning Properties	Excellent
Soft Soldering, Brazing	Excellent
Resistance Welding	Good
Gas Shielded Arc Welding	Excellent
Laser Welding	Good
Soft Annealing	250 .. 650°C, 1 .. 3h
Stress Relieving Annealing	150 .. 200°C, 1 .. 3h

* For more details call our technical service

Corrosion Resistance*

Resistant to:

CuFe2P has a good resistance in in natural and industrial atmosphere (maritime air too).

Industrial and drinking water, aqueous and alkaline solutions (not oxidizing), pure water vapour (steam), non oxidizing acids (without oxygen in solution) and salts, neutral saline solutions.

Practically resistant against stress corrosion cracking

Not resistant to:

Oxidising acids, solutions containing cyanides, ammonia or halogens, hydrous ammonia and halogenated gases, hydrogen sulfide, seawater.

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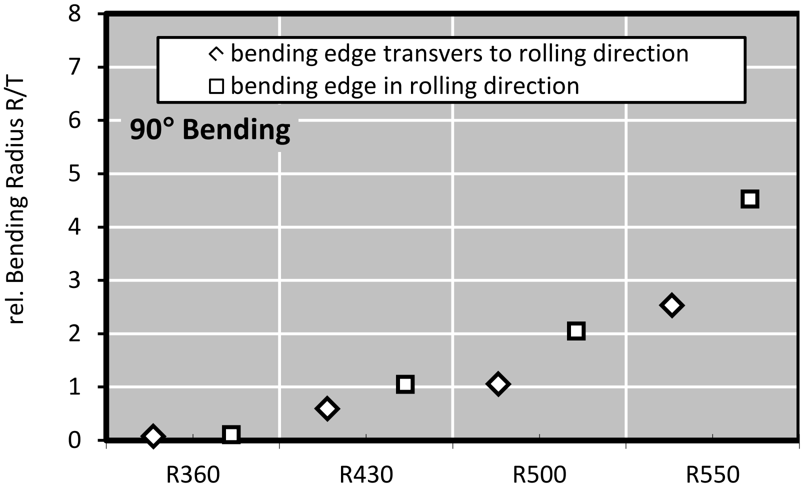
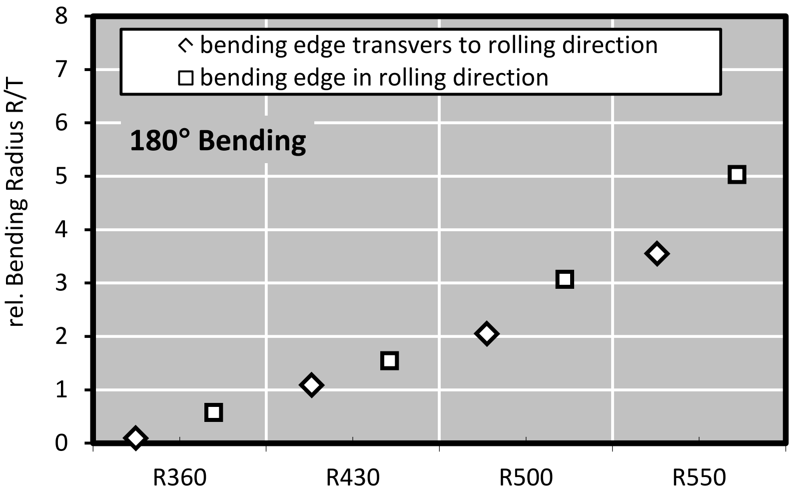
Bending Properties **Thickness: ≤ 0.5 mm** **stress relieved (optimized bending possible on request)**



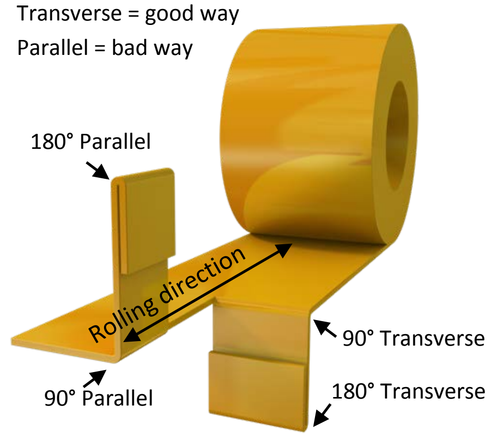


Bending test according to EN ISO 7438 is done with 10 mm wide samples. Smaller samples in general – as well as lower thickness – allow a lower bending radius without cracks. If needed we supply bending optimized temper classes that far exceed standard quality.

Please take care when comparing with ASTM E 290 results, there the bend definition direction is contradictory.

Bending Definition

Transverse = good way
Parallel = bad way



Minimum Bending Radius Calculation

To find out the minimum possible bending radius take the R/T value from the list.

Example: R/T = 0.5 and thickness 0.3 mm

Minimum radius = (R/T) x thickness
= 0.5 x 0.3 mm = 0.15 mm

Bending Properties*

Temper	Thickness Range	Bending 90°		Bending 180°	
		Trans-vers	Parallel	Trans-vers	Parallel
	mm	R/T	R/T	R/T	R/T
R360	≤ 0.5	0	0	0	0.5
R430	≤ 0.5	0.5	1	1	1.5
R500	≤ 0.5	1	2	2	3
R550	≤ 0.5	2.5	4.5	3.5	5

* Measured at sample width 10 mm according to EN 1654
Possible bending radius = (R/T) x thickness

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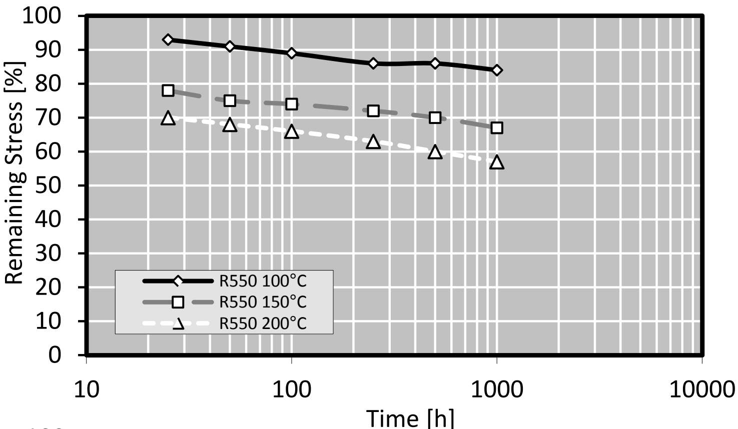
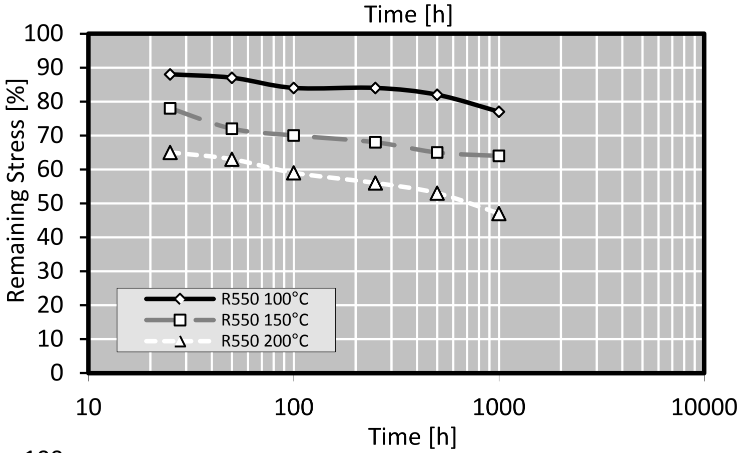
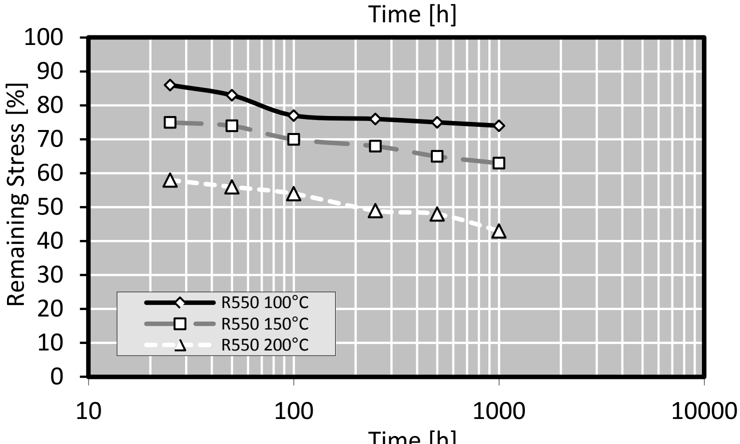
Relaxation Properties Thermal stress relieved



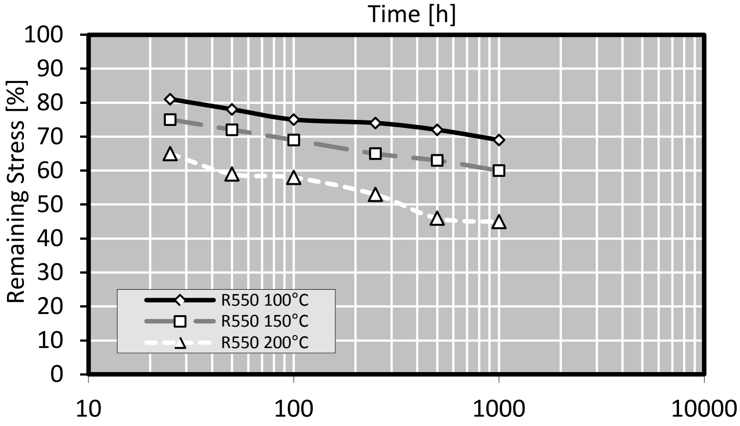
Initial Stress:
50% of Rp0.2
Parallel
Rolling Direction



Initial Stress:
50% of Rp0.2
Transverse
Rolling Direction



Initial Stress:
80% of Rp0.2
Parallel
Rolling Direction

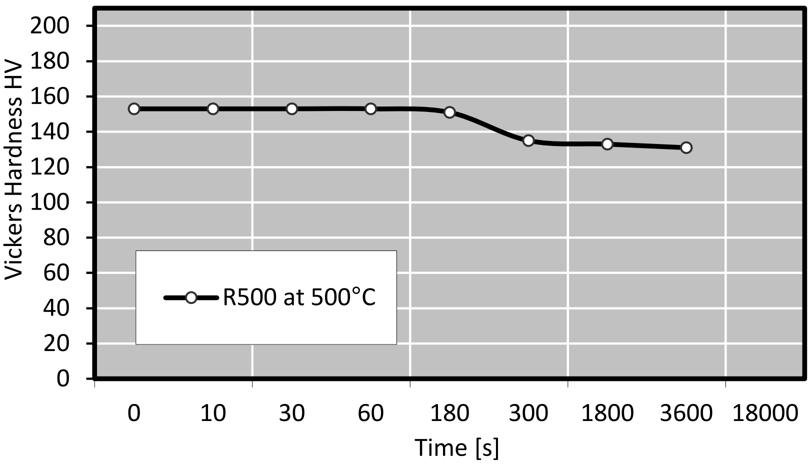


Initial Stress:
80% of Rp0.2
Transverse
Rolling Direction

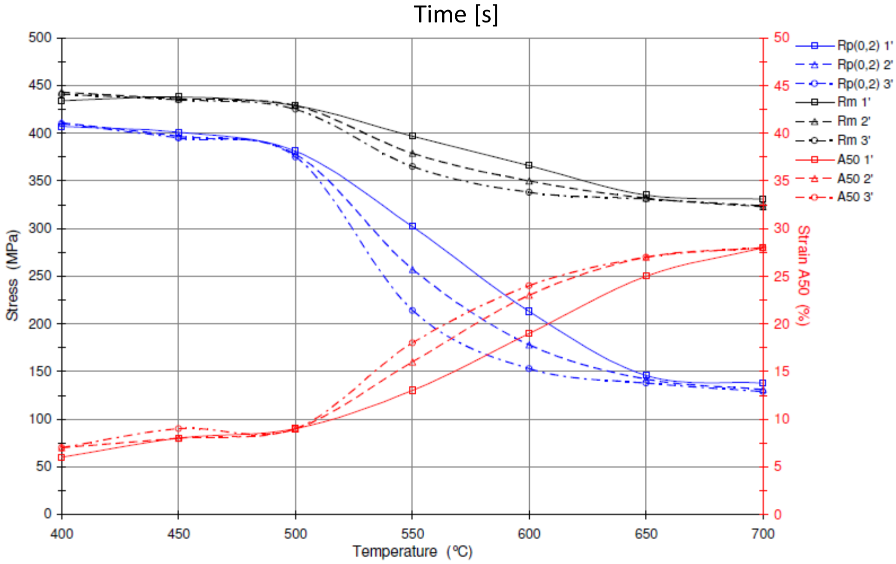
Stress relaxation is tested with cantilever bending test equipment. This method is taking short time relaxation into account. so that the values achieved are very realistic, while other test methods like tube test pretend better properties from the achieved values. Relaxation values give an indication about stress relieve of strip under tension for a certain time and temperature. As it is measured on plain strip. the behaviour of deformed parts may differ. nevertheless the ratio between the different tempers remains the same.

Typical test sample thickness is 0.3 – 0.6 mm.

Softening Resistance



After short time heat treatment Vickers Hardness is measured. The diagram shows typical values.



Short time measurement:

1, 2, 3 minutes at different temperatures from 400 .. 700 °C

Bend Fatigue (at room temperature)

The fatigue strength gives an indication about the resistance to variations in applied tension. It is measured under symmetrical alternating load. The maximum bending load for 10^7 load cycles without crack is measured. Dependent on the temper class it is approximately 1/3 of the tensile strength R_m.

Standards for copper and copper alloys	
EN 1652	Plate, sheet, strip and circles for general purposes
EN 1654	Strip for springs and connectors
EN 1758	Strip for lead frames
EN 13148	Hot-dip tinned strip
EN 13599	Copper plate, sheet and strip for electrical purposes
EN 14436	Electrolytically tinned strip