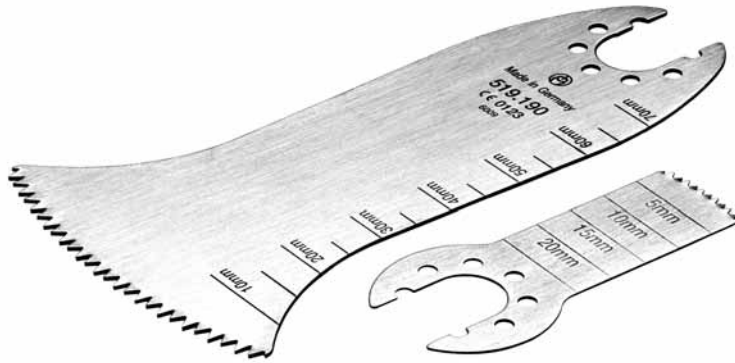


# AGE HARDENABLE SPRING MATERIAL WITH EXTREME STRENGTH NIVAFLEX® 45/18



## MAIN PROPERTIES (typical values):

Extreme tensile strength up to **2900 MPa**  
 Extreme hardness up to **800 HV**  
 Very high bending fatigue strength  
**Excellent corrosion resistance**  
 Non-magnetic  
 Good temperature resistance from -50 to 350 °C

**MATERIAL NUMBER: 2.4782**

**ALLOY COMPOSITION (wt. %):**

Co	Ni	Cr	Fe	W	Mo	Ti
45	21	18	5	4	4	1

NIVAFLEX spring materials are multi-phase alloys on a CoNiCr base. Deformation induced phase transitions together with dislocations and twinning, lead to high work hardening in the delivery state. The mechanical properties can be substantially improved by subsequent precipitation hardening.

In contrast to NIVAFLEX 45/5, the variant NIVAFLEX 45/18 has no beryllium addition. With only a slight loss in strength and hardness, this variant features improved ecological rating and lower production costs.

NIVAFLEX alloys combine excellent mechanical properties with excellent corrosion resistance and non-magnetic behaviour.

## APPLICATIONS:

Highly loadable, fracture-proof spring elements, such as main springs (for watches), springs for measurement and display instruments, torsion and helical springs, membranes and other springs with extremely high repetition accuracy. Depending on the application specified, the optimum degree of cold work is selected to ensure fatigue-proof springs with very high bending fatigue strength.

Precision parts featuring extreme strength combined with high corrosion and wear resistance, e.g. high precision parts for watches or surgical bone saws.

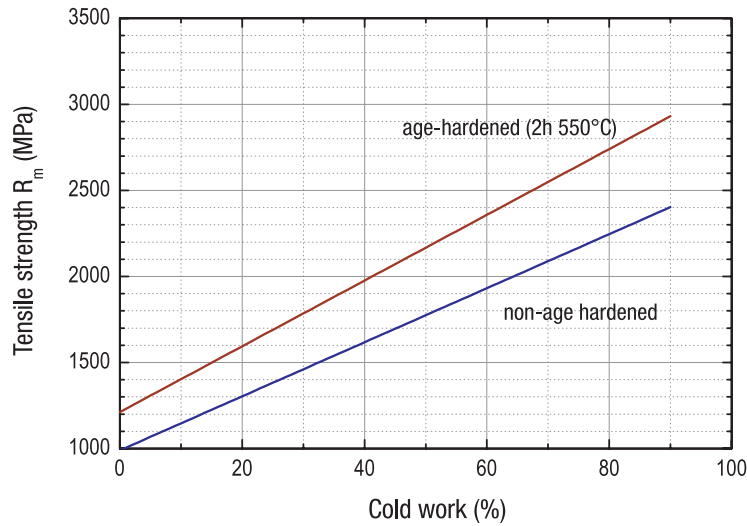
## FORMS OF SUPPLY AND STATES:

Wire Ø 0.2 – 3 mm, cold work as specified by customer.  
 Other diameters and strip on request.

## MECHANICAL PROPERTIES (typical values)

Property		Unit	State of delivery – examples (before / after age-hardening*)		
Degree of cold work	KV	(%)	50	70	90
tensile strength	$R_m$	(MPa)	1775 / <b>2150</b>	2090 / <b>2530</b>	2400 / <b>2930</b>
yield strength (approx. 80% of tensile strength)	$R_{p0.2}$	(MPa)	1420 / <b>1720</b>	1670 / <b>2025</b>	1920 / <b>2345</b>
hardness	HV		– / <b>640</b>	– / <b>715</b>	– / <b>785</b>

\*) Age-hardening 2h, 550 °C; recommended temperature range for age-hardening: 400-600 °C



## PHYSICAL PROPERTIES (typical values)

Property		Unit	
Density	$\rho$	(g/cm <sup>3</sup> )	8.5
Electrical resistance	$\rho_{el}$	( $\mu\Omega m$ )	1.0
Ferromagnetism			no
Young's modulus	E	(GPa)	220
Shear modulus	G	(GPa)	90

## CORROSION RESISTANCE (typical values)

Medium	Room Temperature*	Medium	Room Temperature*
sea water (synthetic)	+++	hydrochloric acid 10 %	+
NaCl solution 10 %	+++	nitric acid 10 %	++
formic acid 10 %	++	sulphuric acid 10 %	++
ammonia 25 %	+++	phosphoric acid 10 %	++
acetic acid 10 %	+++		

*) classification	+++	resistant	corrosion rate < 100 $\mu m/year$
	++	adequately resistant	corrosion rate < 1000 $\mu m/year$
	+	fairly resistant	corrosion rate < 3000 $\mu m/year$
	0	slightly resistant	corrosion rate < 10000 $\mu m/year$
	-	non-resistant	corrosion rate > 10000 $\mu m/year$

The corrosion rates given are nominal values, in practice the material must be tested in the relevant medium under fully operational conditions before use.

