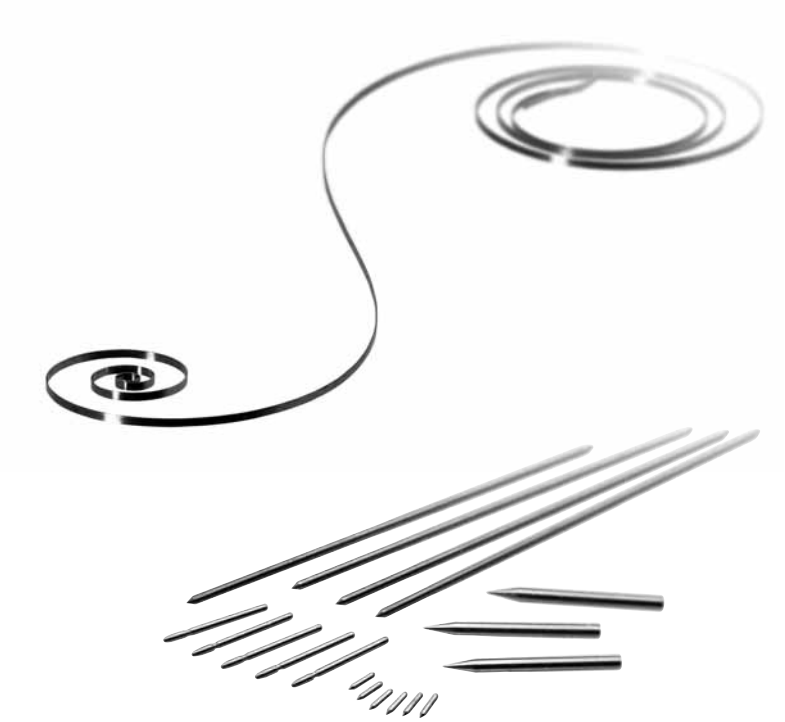
AGE HARDENABLE SPRING MATERIAL WITH MAXIMUM STRENGTH

NIVAFLEX® 45/5



ALLOY COMPOSITION (wt. %):

Co	Ni	Cr	Fe	W	Mo	Ti	Be
45	21	18	5	4	4	1	0.2

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.

By adding beryllium, the variant NIVAFLEX 45/5 achieves extremely high values for strength and hardness, which is particularly advantageous in meeting demands for miniaturization.

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, such as precision axles and shafts, pivot points (bearing pins) for electric motors and water meters as well as main springs for mechanical watches.

MAIN PROPERTIES (typical values)**:**

Extreme tensile strength up to **3000 MPa**
Extreme hardness over **800 HV**
Very high bending fatigue strength
Excellent corrosion resistance
Non-magnetic
Good temperature resistance from -50 to 350 °C

FORMS OF SUPPLY AND STATES:

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

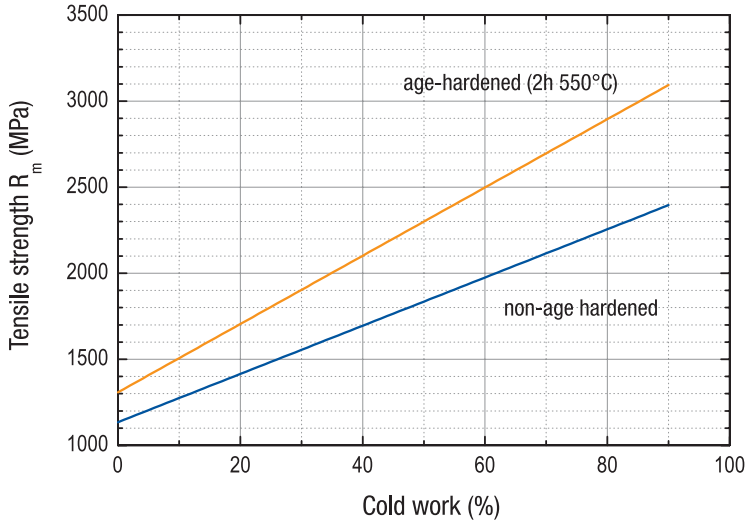
NIVAFLEX® 45/5

FORM OF SUPPLY: **WIRE**

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)	1835 / **2300**	2115 / **2695**	2395 / **3095**
yield strength (approx. 80% of tensile strength)	$R_{p0.2}$	(MPa)	1470 / **1840**	1690 / **2155**	1915 / **2475**
hardness	HV		– / **675**	– / **750**	– / **830**

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



PHYSICAL PROPERTIES (typical values)

Property		Unit	
Density	ρ	(g/cm³)	8.5
Electrical resistance	ρ_{el}	(μΩm)	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 μm/year
	++	adequately resistant	corrosion rate < 1000 μm/year
	+	fairly resistant	corrosion rate < 3000 μm/year
	0	slightly resistant	corrosion rate < 10000 μm/year
	-	non-resistant	corrosion rate > 10000 μm/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.

VACUUMSCHMELZE

VACUUMSCHMELZE GmbH & Co. KG
Grüner Weg 37 D-63450 Hanau
P.O. Box 22 53 D-63412 Hanau
Phone: ++49/6181-38-0
http://www.vacuumschmelze.com

alloy information NIVAFLEX® 45/5
HT-PM H
Issue: January 2008