

Nilo 42 Alloy

Heanjia Super Metals Co., Ltd

Nickel – Iron 42 alloy consists of 42% Nickel. The alloy offers low temperature coefficient of thermal expansion up to 300oC. It is utilized in tooling for aerospace applications, thermostat rods, lead frames and bimetallic strips, glass sealing operations in microelectronic parts, vacuum devices and electric bulbs.

Chemical composition of Nilo alloys:

Alloy	Ni	Fe	Others
NILO alloy 36	36	64	-
NILO alloy 42	42	58	-
NILO alloy 48	48	52	Nb 3.3,Ti 1.4, C 0.02
Nilo K	29.5	53	Co 17.0
NiloMag 77	77	13.5	Cu 5.0, Mo 4.2

Physical properties of Nilo alloys

Material	Density		Thermal conductivity		Specific heat capacity		Energy needed to heat 1m3 tool to 180°C	
	lb/in3	g/cm3	Btuin/ft2 hoF	W/moC	Btu/lb °F	J/kg °C	kW h	MJ
NILO 36	0.293	8.11	73	10.5	0.12	500	186	670
NILO 42	0.293	8.11	73	10.5	0.11	460	168	605
NILO 365	0.293	8.11	86	12.4	0.12	500	180	648
Graphite Epoxy	0.058	1.6	24	3.5	0.18	750	54.2	195
Monolithic Graphite	0.060	1.67	-	-	0.31	1300	95.9	345
Electroformed Nickel	0.311	8.65	761	110	0.11	460	176	635
Aluminum	0.098	2.73	1127	163	0.22	920	111	400

Melting and Inflection Points of Nilo Alloys

Alloy	Melting Point		Inflection Point	
NILO alloy 36	1430	2605	220	430
NILO alloy 42	1435	2615	370	700
NILO alloy 48	1450	2640	460	860
NILO alloy 52	1450oC	2640	450	840
NILO alloy K	1450oC	2640	450	840

Thermal conductivity at 20oC

Alloy	W/m°C	Btu in/ft²h °F
NILO alloy 36	10	69.3
NILO alloy 42	10.5	72.8
NILO alloy 48	16.7	11.6
NILO alloy K	16.7	11.6

Electrical resistivity

Temperature	Microhm cm

oC	oF	NILO alloy 36	NILO alloy 42	NILO alloy 48	NILO alloy K
20	68	80	61	47	43
100	212	86	70	54	55
200	392	97	87	71	72
300	572	105	101	89	88

Thermal expansion of Nilo 42 alloy

Temperature Range		Total Expansion	Mean Linear Coefficient	
oC	oF	10(-3)	10 /°C	10 /°F
20 – 100	68 - 212	0.42	5.3	2.9
20 – 150	68 - 302	0.69	5.3	2.9
20 - 200	68 - 392	0.95	5.3	2.9
20 – 250	68 - 482	1.22	5.3	2.9
20 – 300	68 - 572	1.48	5.3	2.9

Mechanical properties of Nilo 42 alloy:

Temperature		Tensile strength		Yield Strength		Elongation on 50 mm (2 inch) %	Reduction of Area %
oC	oF	MPa	Ksi	MPa	Ksi		
20	68	490	71.0	250	36.0	43	72
100	212	450	65.0	210	30.0	43	72
200	392	450	65.0	130	19.0	43	72
300	572	410	59.0	110	16.0	44	72
400	752	370	54.0	93	13.0	44	71

Hardness

Alloy	HV	HRB
NILO alloy 36, annealed	150 max.	80 max
NILO alloy 42, annealed	140 max.	76 max
NILO alloy 48, annealed	150 max	80 max
NILO alloy K, annealed	160 max.	83 max
NILOMAG alloy 77, annealed	170 max	86 max

Elastic modulus of Nickel iron alloys

Alloy	Elastic Modulus	
	GPa	10(3) ksi
Nickel iron alloy 36	140	20.3
Nickel iron alloy 42	150	21.8
Nickel iron alloy 48	160	23.2
Nickel iron alloy K	130	18.9

Effect of Temperature

The temperature plays wide role in altering the magnetic properties of Nilo alloy such as the coercive force and residual induction regularly decrease with an increase in temperature without variation in the phase. It might be noted that hysteresis loop for alloy decreases with rise in temperature. Moreover the fabrication influences the magnetic features.

These are shown in the below table:

Heat Processing	Initial Permeability
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1 hr. 800°C. 60°C/hr. Furnace cool to Room Temp	800
1 hr. 900°C. 60°C/hr. Furnace cool to Room Temp.	900
1 hr. 1000°C. 60°C/hr. Furnace cool to Room Temp	800
1 hr. 1100°C. 60°C/hr. Furnace cool to Room Temp.	800
4 hr. 1100°C. 60°C/hr. Furnace cool to Room Temp.	500
1 hr. 1200°C. 60°C/hr. Furnace cool to Room Temp.	500

Applications of Nilo 42 Alloy

1. Bimetallic Strips
2. Vacuum devices
3. Electric bulbs.

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