

N42

CONTROLLED EXPANSION ALLOY

I. INTRODUCTION

N42 is an iron-nickel alloy containing 41% nickel, and is characterized by a low expansion coefficient up to temperatures of the order of 350°C.

It is used :

- For the manufacture of integrated circuit supports (lead frames) where its low expansion coefficient matches that of the silicon chips
- For the manufacture of electron gun components for television sets
- For sealing to certain types of glasses and ceramics :
 - Ceramic casings for integrated circuits
 - Spark gaps,
 - Bases for active and passive components.

N42 is refined and processed to meet the demands of the ASTM F (30.96) standard.

II. TYPICAL ANALYSIS

Ni	C	Si	Mn	Fe
41	0.02	0.10	0.5	balance

III. COEFFICIENT OF THERMAL EXPANSION

(data treatment according to ASTM F15)

Temperature range °C	Mean CTE $\times 10^{-6} \cdot ^\circ\text{C}^{-1}$
30 – 100	4.5
30 – 200	4.4
30 – 300	4.5
30 – 400	6.0
30 – 450	7.1
30 – 500	7.7
30 – 600	9.0

Because the N42 alloy conserves its fully austenitic structure right down to very low temperatures, its thermal expansion characteristics are reversible.

IV. TYPICAL VALUES OF OTHER PHYSICAL PROPERTIES

Property	Value
Density	8.15 g.cm ⁻³
Curie point	330°C
Melting temperature	1 425°C
Electrical resistivity	63 μΩ.cm
Thermal conductivity	12.5 W.m ⁻¹ .°C ⁻¹
Specific heat	500 J.Kg ⁻¹ .°C ⁻¹

V. MECHANICAL PROPERTIES

Typical mechanical properties (adjustable depending on the thickness and application)

	Annealed condition	Quarter hard condition	Half hard condition
Vickers hardness	140	180	205
0.2% YS (MPa)	315	450	600
UTS (MPa)	510	580	670
% elongation on 50 mm	30	17	10
Young's modulus (MPa)	145 000		

VI. DEEP DRAWING

After annealing, the cold rolled strip has good drawability.

Thickness (mm)	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.25	1.50
Erichsen test IE 20 (mm)	≥ 5.2	≥ 6.1	≥ 6.9	≥ 7.5	≥ 8.1	≥ 8.5	≥ 8.8	≥ 9.1	≥ 9.4	≥ 9.6	≥ 9.9	≥ 10.3

VII. AVAILABLE FORMATS

N42 is delivered mainly in the form of cold rolled strip :

- Thickness from 0.10 mm* to 2.5 mm
- Width up to 630 mm

** much smaller thicknesses can be produced on request, after study.*

VIII. IMPLEMENTATION

➤ Machining

The machinability of N42 is comparable to that of other Fe-Ni alloys. It is a « sticky » material with a tendency for the chips to adhere to the tool.

Relatively low cutting speeds are therefore recommended (similar to those for austenitic stainless steels).

	Turning	Milling	Drilling
Tool	S3 or 34 carbide	Improved high speed steel	High speed steel
Lubricant	Soluble oil	Soluble oil	Soluble oil
Cutting angle (°)	12 – 17	15	
Rake angle (°)	5 – 8	3 – 7	9 – 13
Cutting speed (m/mn)	50 – 75	10 – 15	10
Advance rate (mm)	0.2 – 0.5 / rev	0.05 – 0.10 / tooth	0.10 / rev

➤ Brazing

Hard brazing with copper, copper-silver, etc. is to preferred to soft soldering

To avoid all risk of stress corrosion cracking, the parts to be joined must be completely free from internal tensile stresses.

For this reason, it is recommended to perform a prior stress relieving treatment at 700 – 800°C before brazing.

➤ Welding

Welding should preferably be carried out in the annealed condition.

Oxy-acetylene, TIG and resistance welding can be performed taking the same precautions as for stainless steels.

Please consult us for estimates.