Alternatives for Cu-Be by JX Nippon Mining & Metals

Cu-2%Be C172 → ***NKT322 C19910 (Cu3Ti-0.2Fe)***

Dilute Cu-0.2%Be-Ni → ***NKC286 C64728 (Cu-Ni-Si)***

NKC388 C70252 (Cu-Ni-Si)

High Strength Hyper Titanium Copper
"GIGALLOY" NKT322, C19910

Chemical composition

(wt%)

	Ti	Fe	Cu+Ti
nominal	2.9 – 3.4	0.17 – 0.23	over 99.5

"Environment-recycling is allowed."

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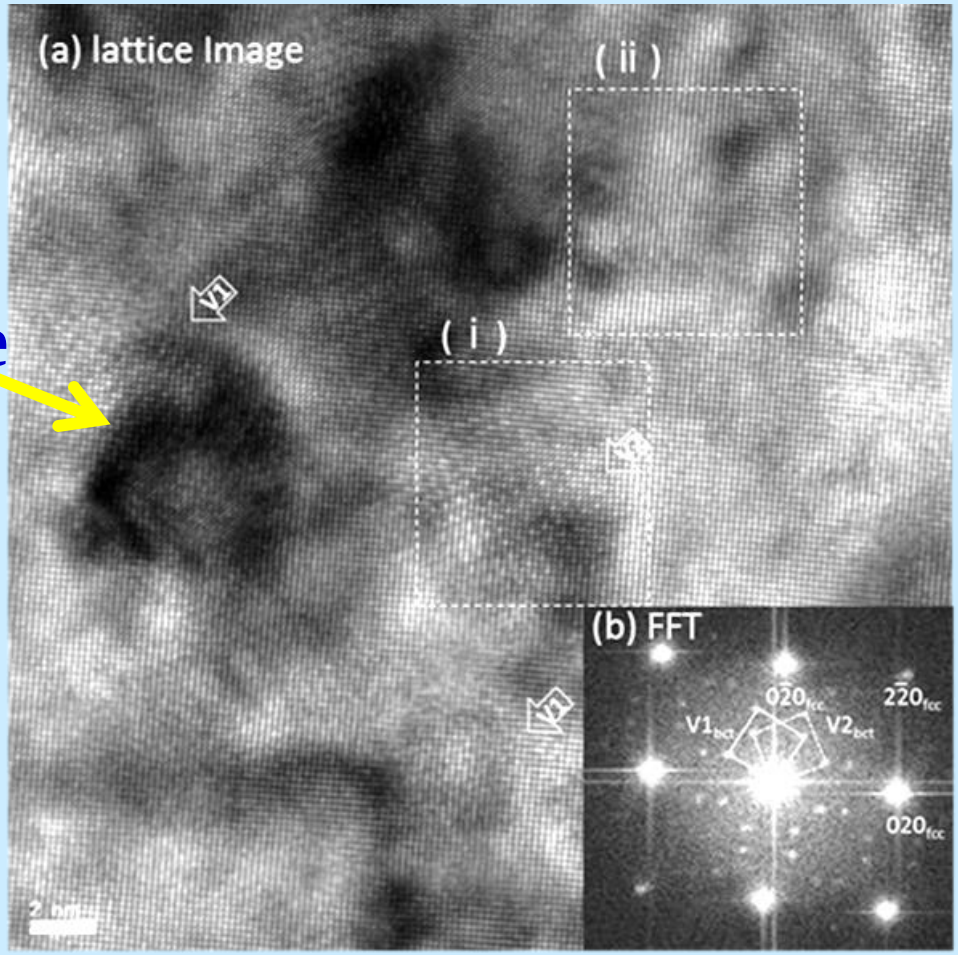
What is Cu-Ti alloy ?

Cu-Ti particle

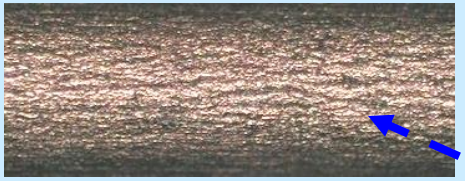


Extremely fine Cu-Ti particles in Cu-Ti alloy

JX established the manufacturing processing for Cu-Ti alloy.

"GIGALLOY" NKT322

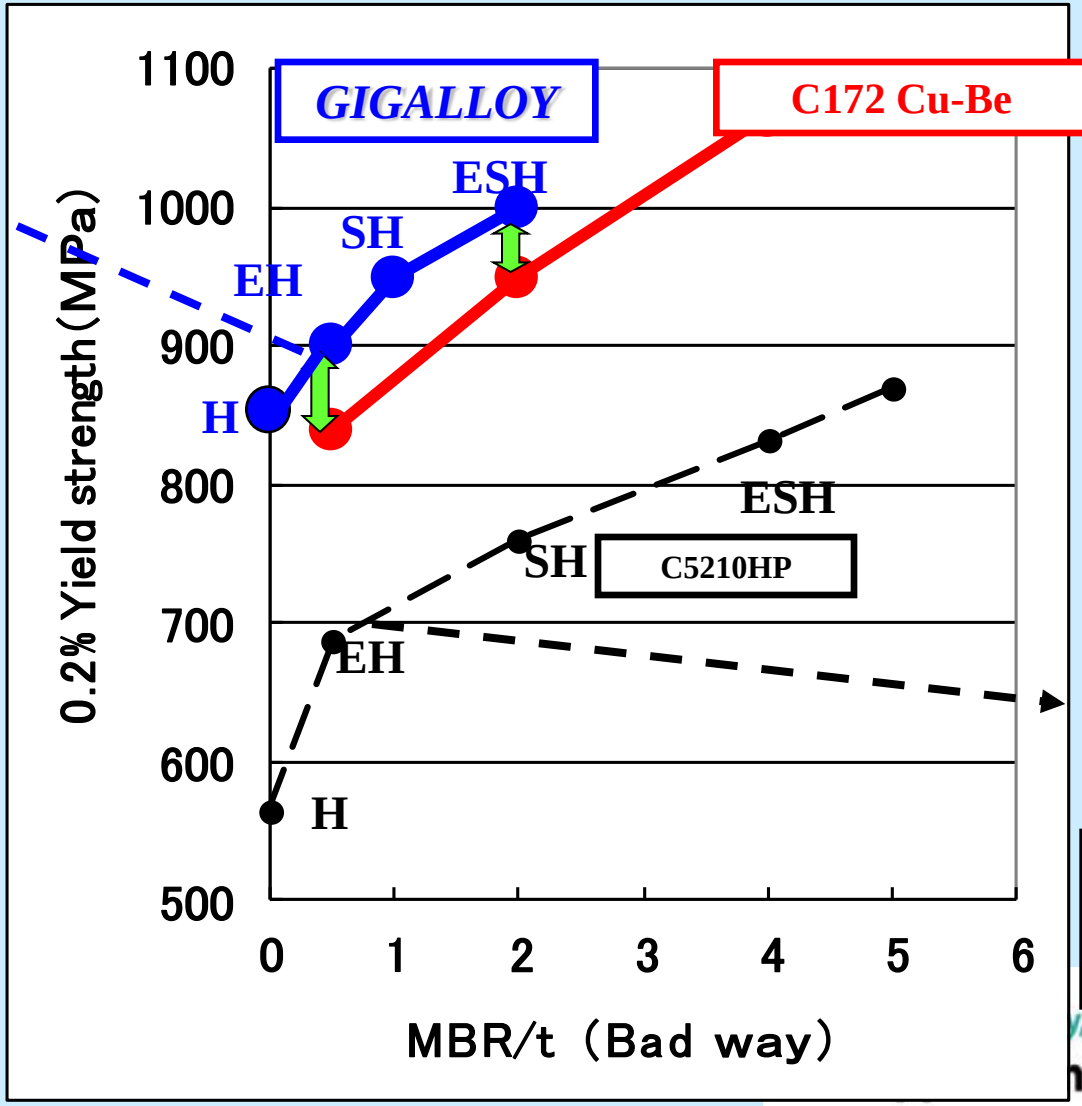
Higher Strength and Better Formability

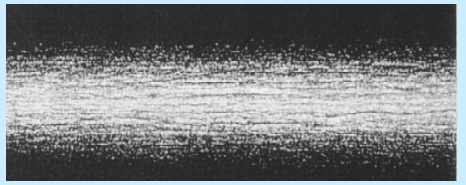


NKT322-EH

90° W Bend Test Badway)

R/t=0.5





C5210HP-EH

90° W Bend test (Badway)

R/t=1.0

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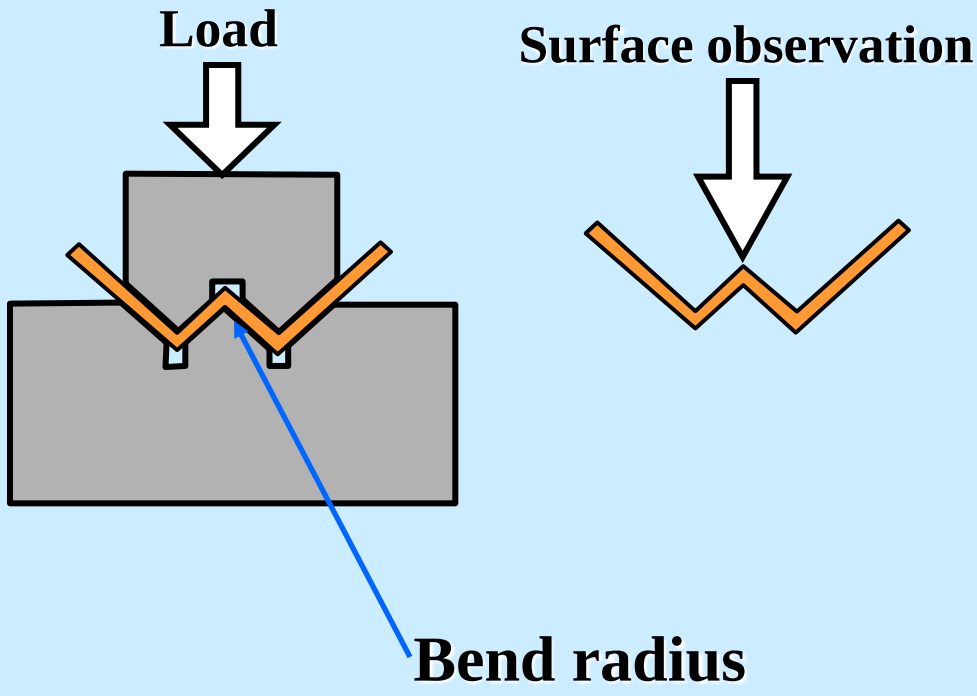
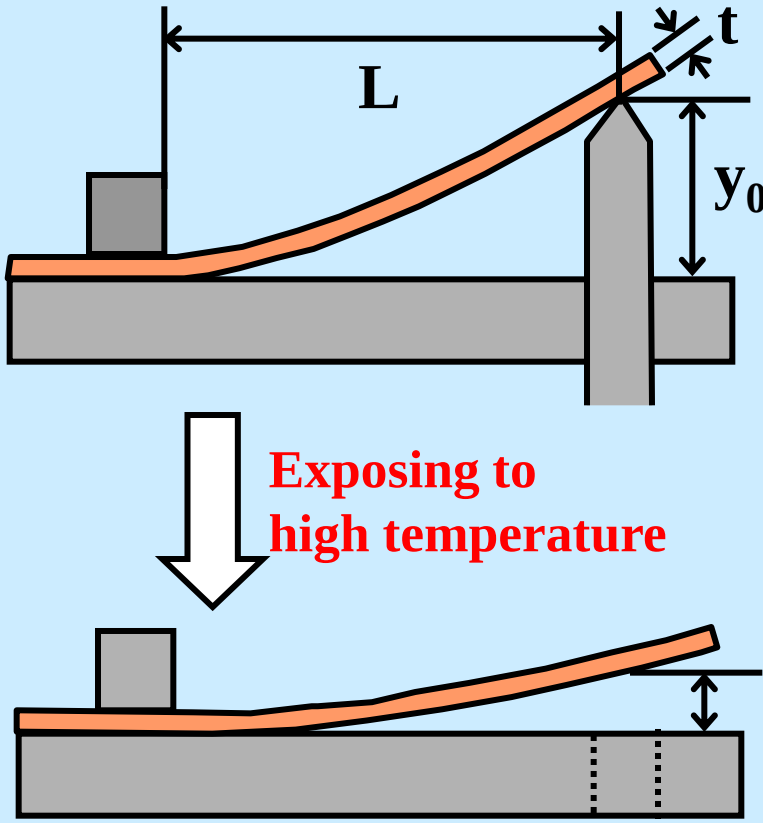


W-type bend test for formability evaluation

Stress Relaxation Test



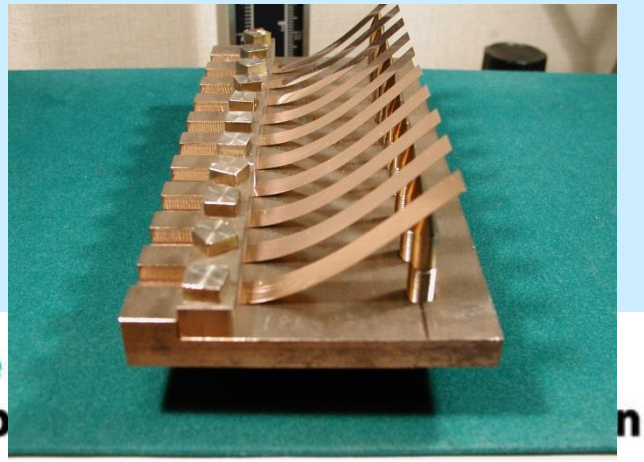
$y_0 = 2L^2\sigma/(3Et)$

E: Modulus of Elasticity

σ: Applied stress
（ex. 80% of yield strength）

Stress Relaxation (%) = y/y_0 x 100

Stress Remaining (%) = $(1 - y/y_0)$ x 100



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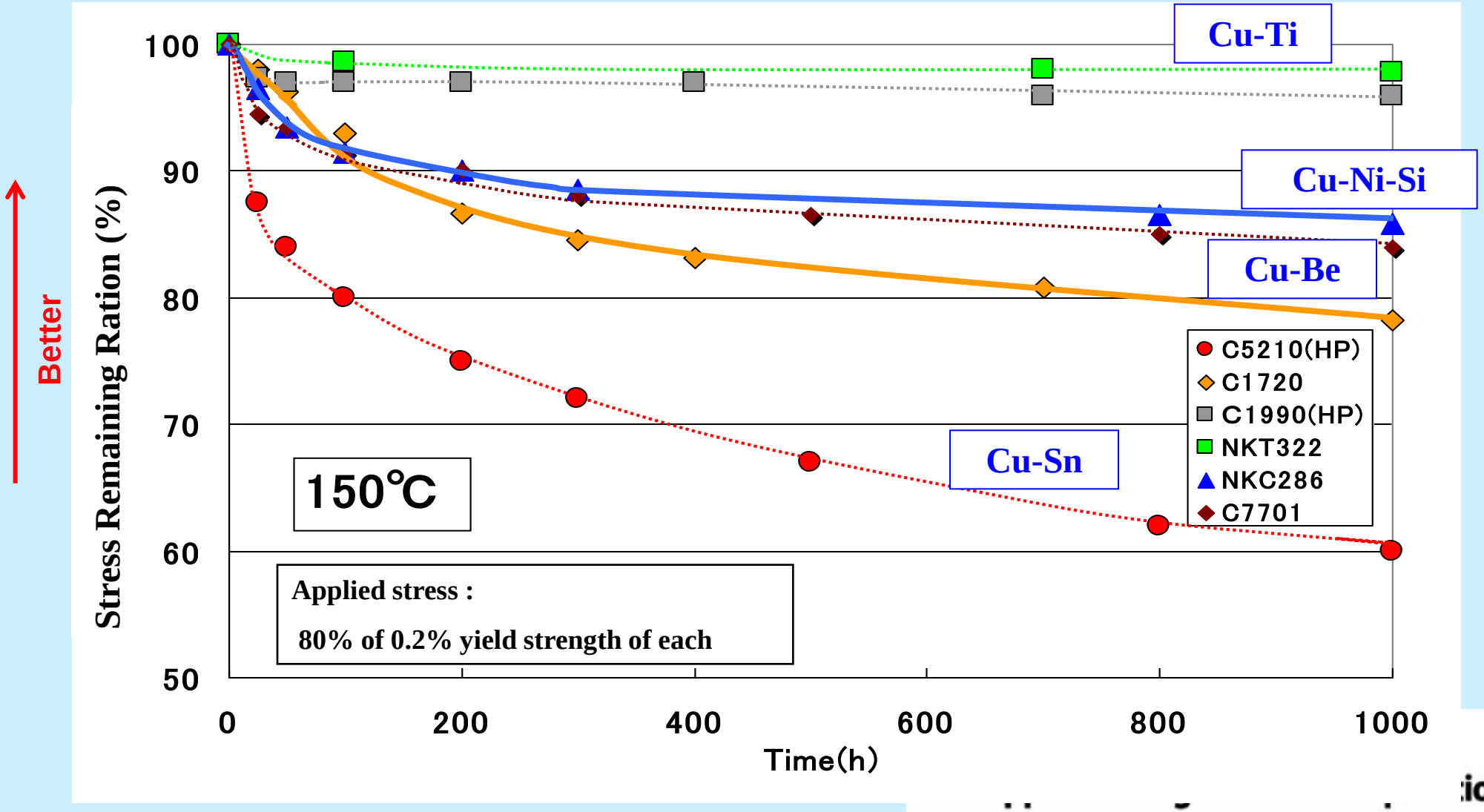
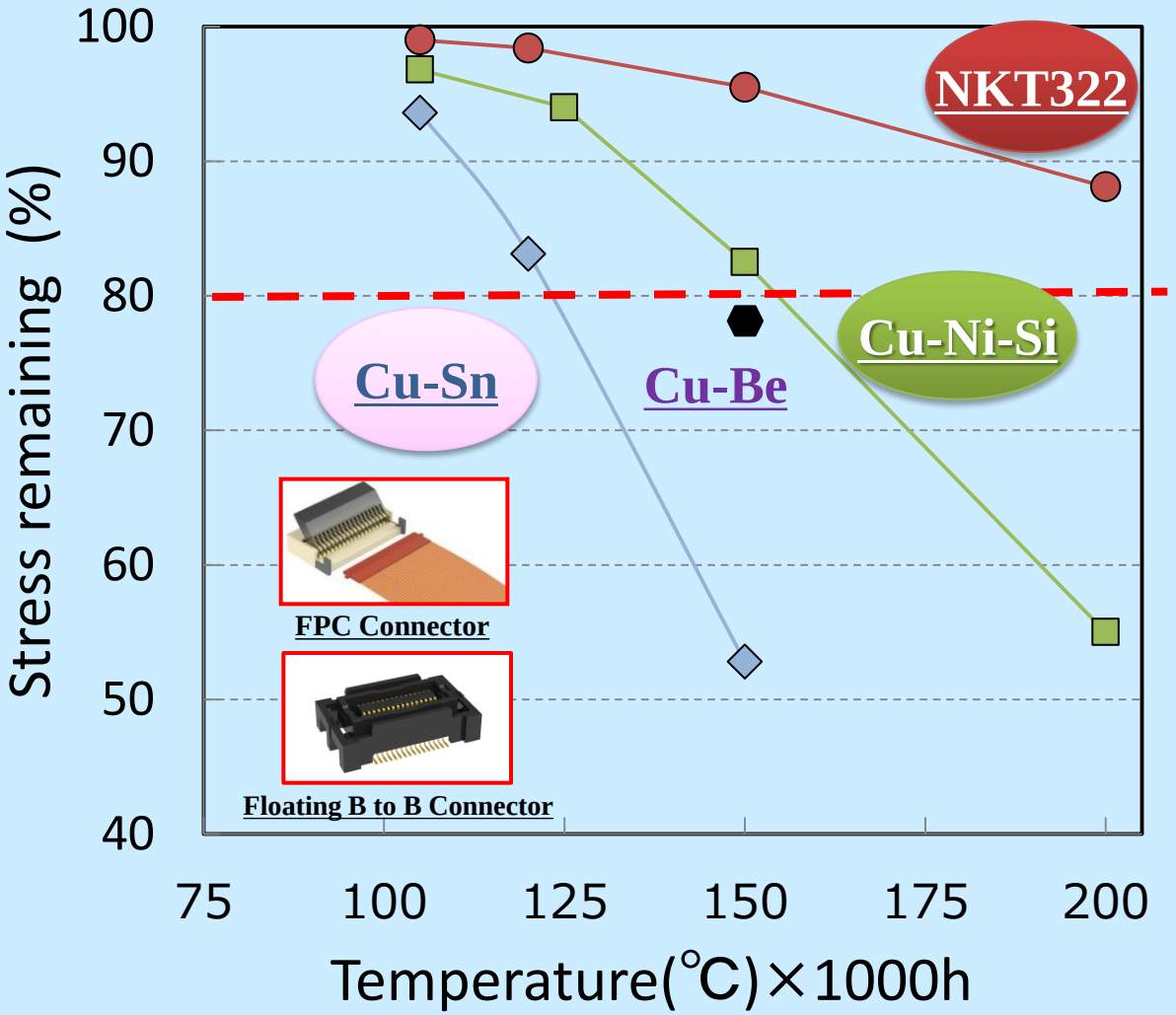
Stress Relaxation Resistance of Copper Alloys

NKT322 provides only 4% of stress relaxation after 1000hours at 150 degree C.



Stress Relaxation Resistance of NKT322 at elevated temperatures



GOOD

Over 20% of stress remaining should be needed for elevated temperature connectors in Automotive

Shifted to high stress relaxation resistant copper alloys

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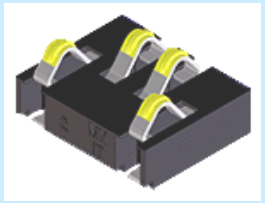
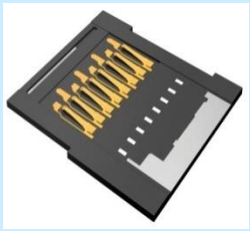
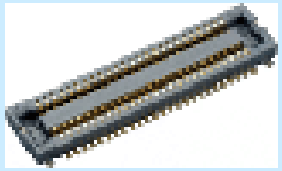
Cu-Ti Alloy “Eco Alloy” in Mobile Phone Connectors



Battery Terminal : NKT322

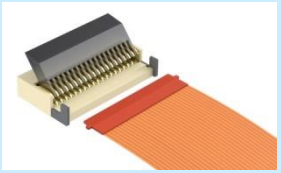


SIM Connector : NKT322



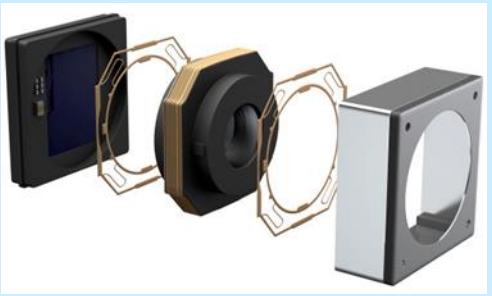
B to B : NKT322

Ground Contact : NKT322



FPC Connector : NKT322

Jack : NKT322



AFM Spring :

C1990-GSH 30um, 40um, 50um

Standard thickness for higher availability

0.08, 0.1, 0.12, 0.15, 0.2, 0.25, 0.3 (mm)

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Advantages of NKT322 for Cu-Be Alternative by QCDE

1. Quality, Property

Higher strength and better formability than Cu-Be, and also Excellent cyclic fatigue property

2. Cost

NKT322 is competitive to Cu-Be C172, depending on thickness & volume.

3. Delivery

Local sourcing through several delivery centers in Far East Asia and also Europe & US.

4. Environment

"Green alloy" as environmental recycling-friendly

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Alternative Copper Alloys to dilute Cu-Be

High Strength Titanium Copper "GIGALLOY"

Cu-2%Be C172 ⟹ ***NKT322 C19910*** *(Cu-3Ti-0.2Fe)*

Dilute Cu-0.2%Be-Ni ⟹ ***NKC286 C64728*** *(Cu-Ni-Si)*

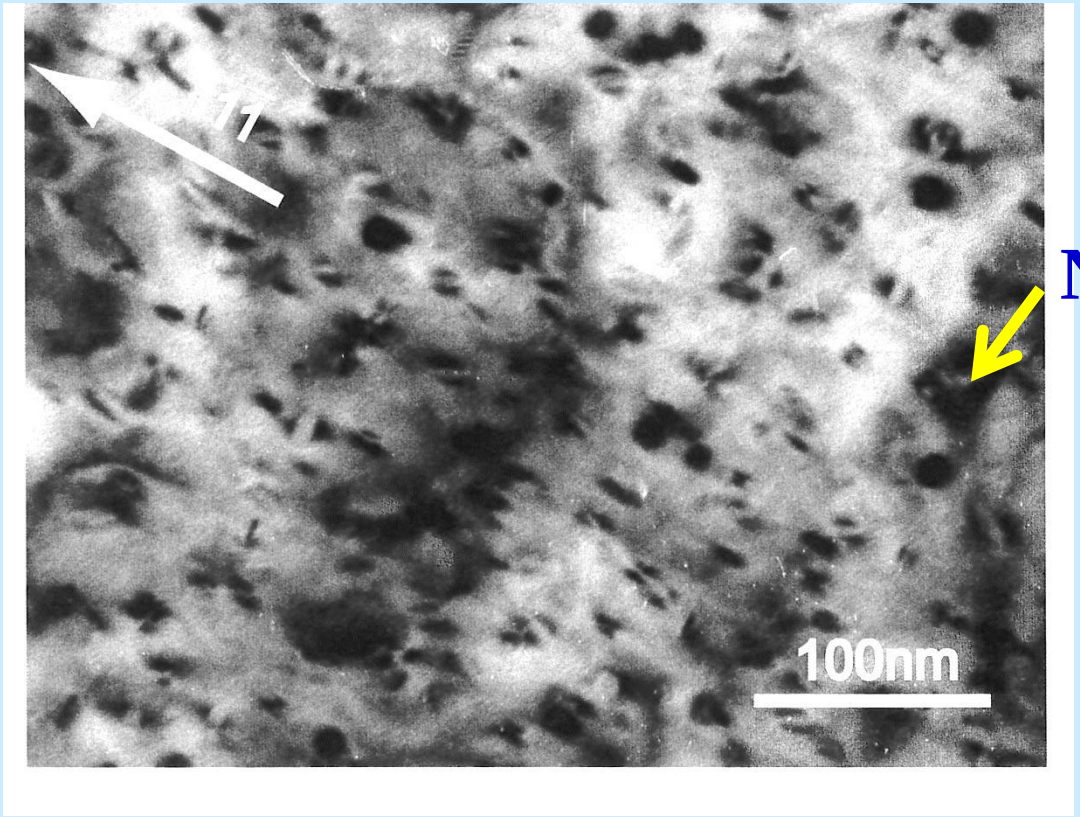
NKC388 C70252 *(Cu-Ni-Si)*

Corson Alloy　Cu-（Ni, Co）- Si

- Dr. M. G. Corson invented Corson alloy in 1927.
- Cu－(1.5-4%) Ni, Co －(0.4-1%) Si

  Ni, Co / Si ≒ 2/1（molar ratio）
- Precipitation of Ni_2Si or Co_2Si compound
- High strength and High conductivity
- Many kinds of Corson alloys are developed

What is “Corson Alloy ”?



Ni_2Si particle

In 1929, Dr. M.G.Corson developed Cu- Silicide alloy such as Cu-Ni-Si or Cu-Co-Si. Since then, the type of alloy is called “Corson alloy” after him.

High Strength – High Conductivity
NKC286(C64728)

Chemical composition

wt%

	Cu	Ni	Si	Sn	Zn
Nominal	Bal.	2.8	0.6	0.5	0.4

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Highest Strength Corson NKC388 (C70252)

Chemical composition

wt%

	Cu	Ni	Si	Mg	Mn
nominal	bal.	3.4～4.2	0.7～1.0	0.05～0.3	0.11～0.5

Temper

	Tensile (MPa)	0.2% yield (MPa)	Minimum Bend Ratio / thickness (Bad way)
SH	940	910	1.0
ESH	980	950	3.0

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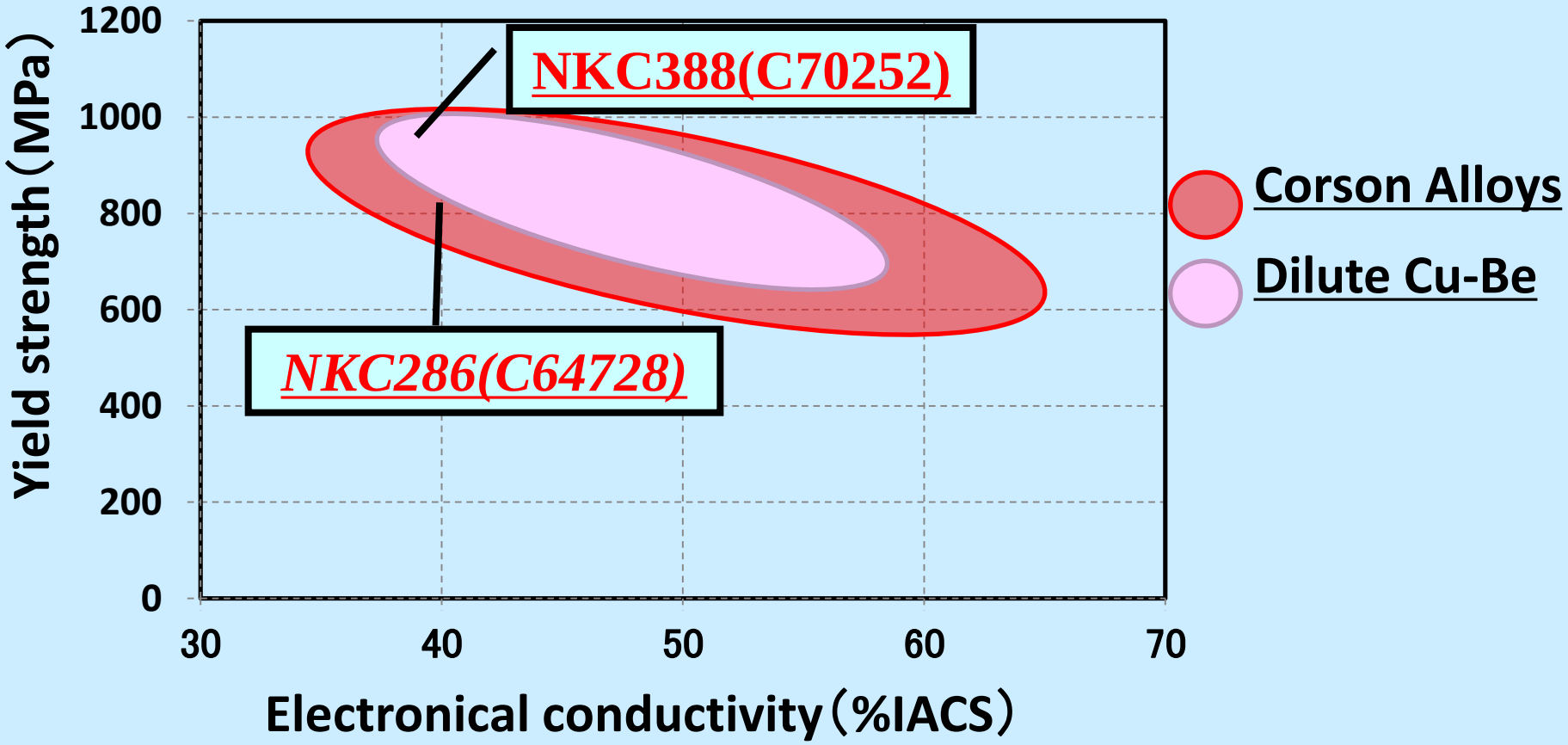
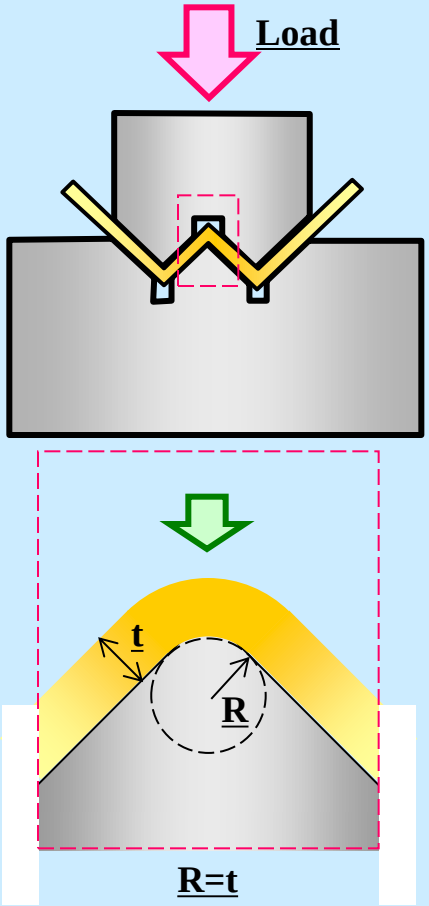
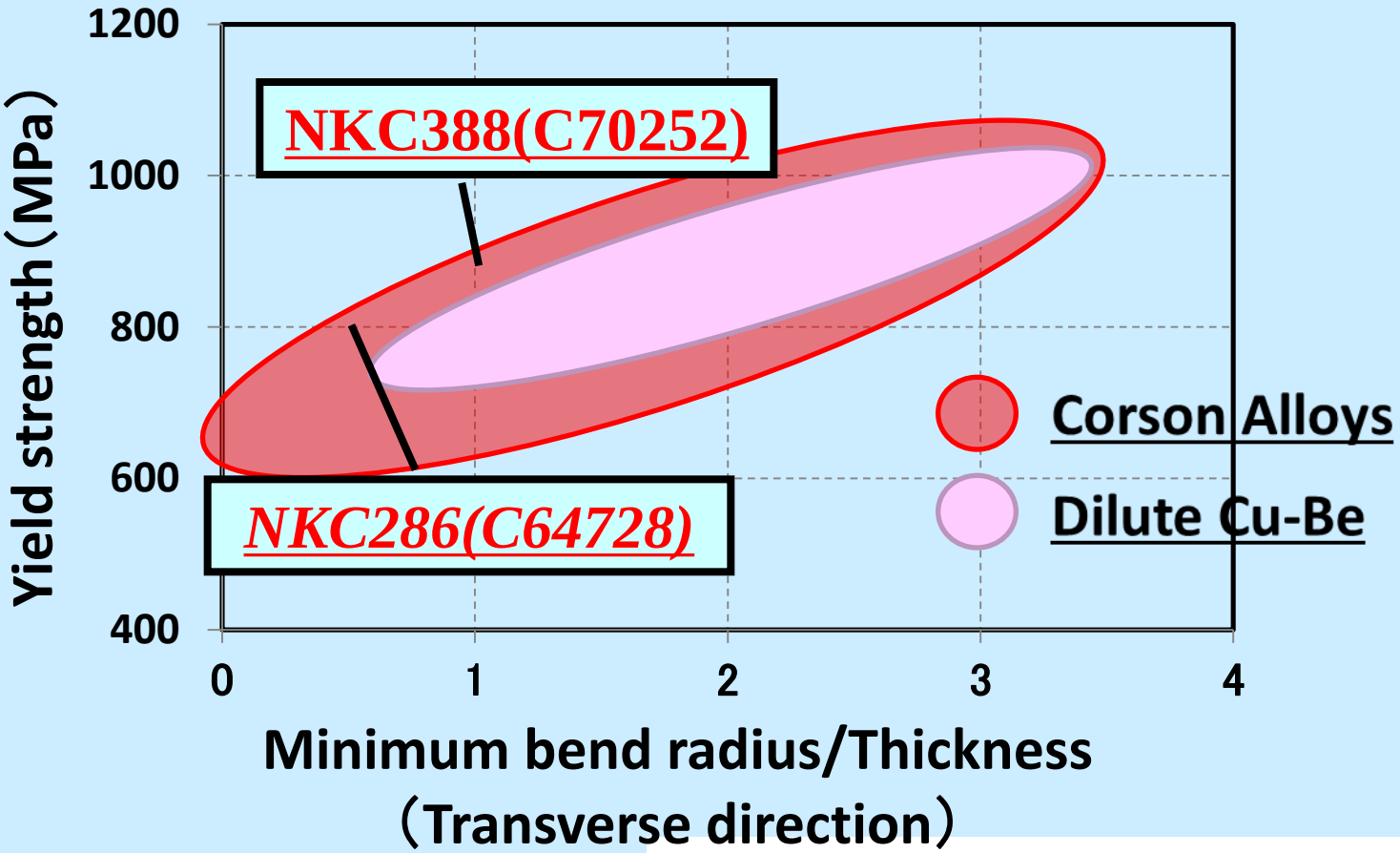
Strength and Conductivity of Corson Alloys and Dilute Cu-Be Alloys



Strength and Bend formability of Corson Alloys and Dilute Cu-Be Alloys





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Summary

- ✓ **Very high strength Cu-Ti alloy, NKT322 has been already commercialized for alternative to Cu-Be C172.**
- ✓ **High strength & high conductivity Corson alloys have been already commercialized for alternative to Cu-dilute Be alloys.**