Technical Data

High Performance Copper Alloy

NKC388

UNS Alloy No.C70252

JX Nippon Mining & Metals Corporation

1. Introduction

NKC388 alloy provides an extremely high strength in comparison with conventional Cu-Ni-Si alloy, maintaining the well-balance of strength, conductivity and bend formability. This technical brochure should help your understanding of NKC388 .

＊This data included are nominal numbers.

2. Features

（1）High strength and high conductivity

（2）High stress remaining resistance

（3）Good bend formability

3. Chemical Composition

Table.1 Chemical Composition of NKC388 （wt%）

	Cu	Ni	Si	Mg	Mn
Typical	Bal.	3.4～4.2	0.70～1.0	0.05～0.3	0.11～0.20
Nominal	Bal.	3.8	0.8	0.1	0.13

4. Physical Properties

Table.2 Physical properties of NKC388

Temper	SH	ESH	XSH	USH
Electrical Conductivity	38 %IACS（@20℃）	34%IACS（@20℃）		
Specific Resistance	45.4 nΩ･m （@20℃）	50.7 nΩ･m （@20℃）		
Thermal Conductivity	160 W/mK	143 W/mK		
Thermal Expansion Coefficient	17.6 $\times 10^{-6}$ /K（20 to 300℃）			
Young's Modulus	123 kN/mm^2		L.D. 123kN/mm^2 T.D. 135kN/mm^2	L.D. 120kN/mm^2 T.D. 140kN/mm^2
Density	8.82 g/cm^3			

5. Mechanical Properties

Table.3 Mechanical properties of NKC388

Temper	Tensile Strength (N/mm^2)	Yield Strength (N/mm^2)	Elongation (%)	HV
SH	940 (890-990)	910 (860-960)	3 (min 1.0)	280 (250-310)
ESH	980 (930-1030)	950 (900-1000)	2.5 (min 1.0)	295 (265-325)
XSH	1030 (970-1090)	1000 (940-1060)	2.0 (min 1.0)	325 (285-350)
USH	L.D.:1030 (970-1090) T.D.:1130 (1070-1190)	L.D.:1000 (940-1060) T.D.:1100 (1040-1160)	L.D :2.0 (min 1.0) T.D.:2.0 (min 1.0)	325 (285-350)

Upper numbers: Typical mechanical properties.

Lower numbers: Requirements for each temper

6. Strength-Conductivity Relation

Fig.1 indicates the strength-conductivity relation for connector copper alloys. NKC388 provides the outstanding strength, and also adequate electrical conductivity.

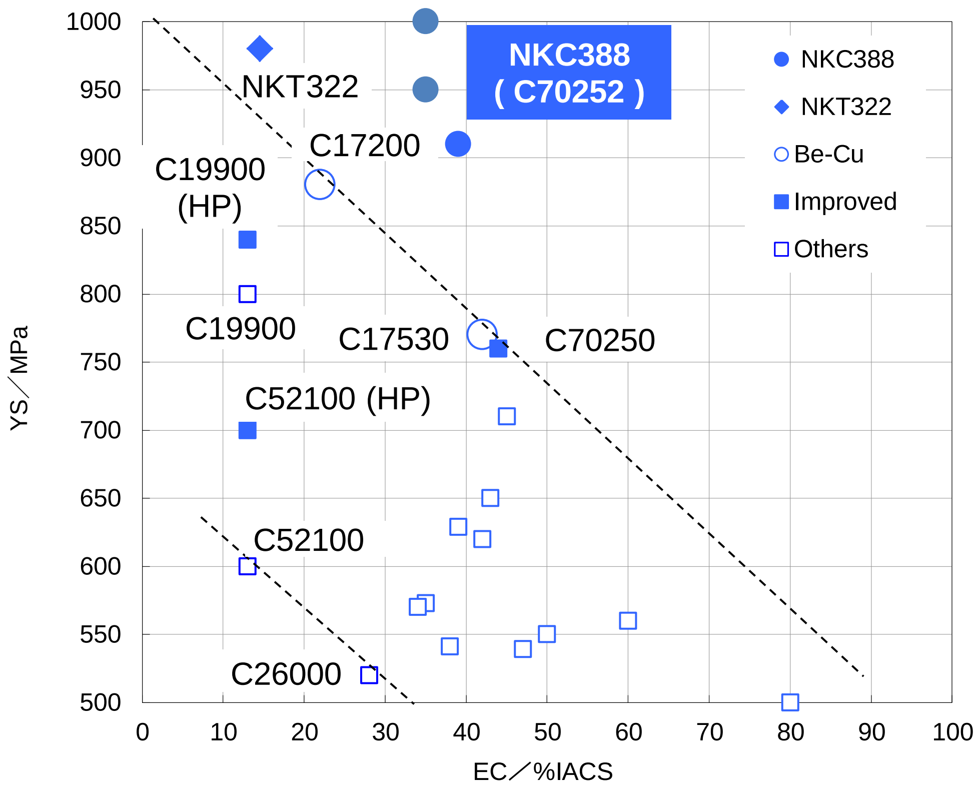


Fig.1 Strength and conductivity of connector alloys

7. Bend Formability

W shaped bending test was performed to evaluate bend formability of NKC388. The minimum bending radius (MBR) without surface crack is determined(specimen size: thickness×10mm^{w}×60mm^{l}). Table.4 shows MBR/t (Minimum Bend Radius/Thickness). NKC388 has high strength and good bend formability. Fig.3 and 4 shows MBR/t vs w/t(width/thickness) for Temper-SH. Bend formability enhances more as width of specimen is smaller. For example, Temper-SH of 0.6mm width and 0.15mm thickness can be bent up to 1.5R in bad way.

Table.4 Bend formability of NKC388

Temper	MBR / t	
	Good way	Bad way
SH	1.5	1.0
ESH	2.0	3.0

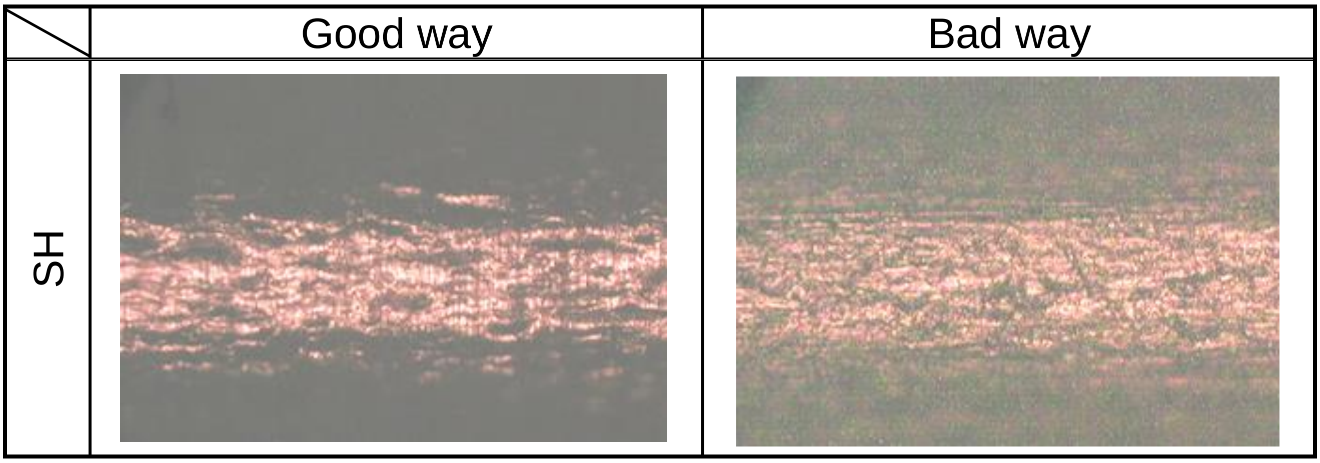


Fig.2 Surface appearance of 90 deg. W shaped bending test specimens

bend radius／thickness =1.0 , Width = 10mm , Thickness = 0.08mm

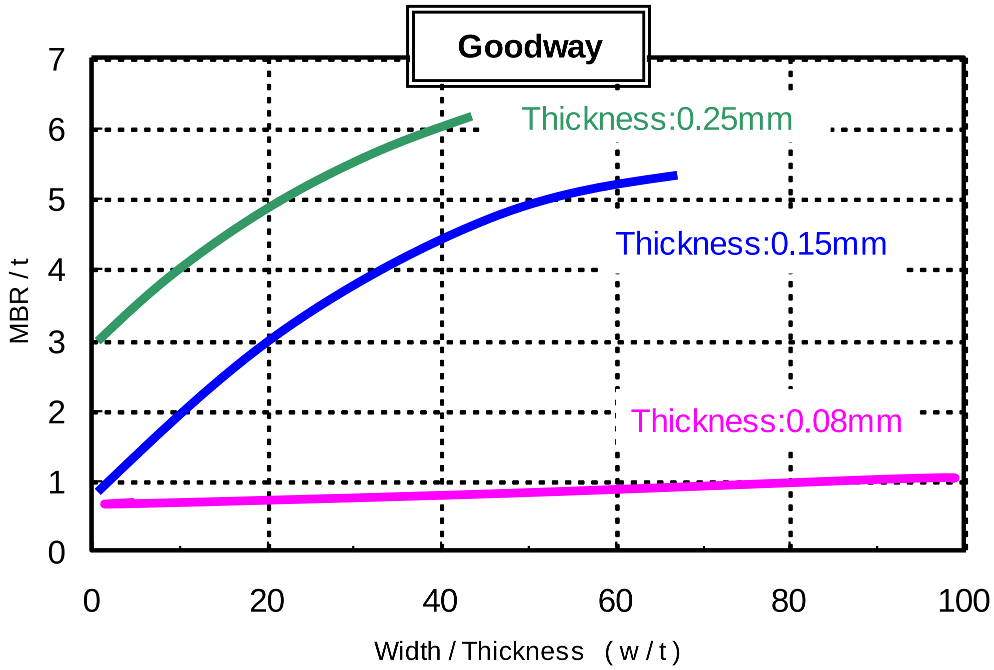


Fig.3 Bend formability variation (good way) of NKC388-SH in case changing width of specimen.

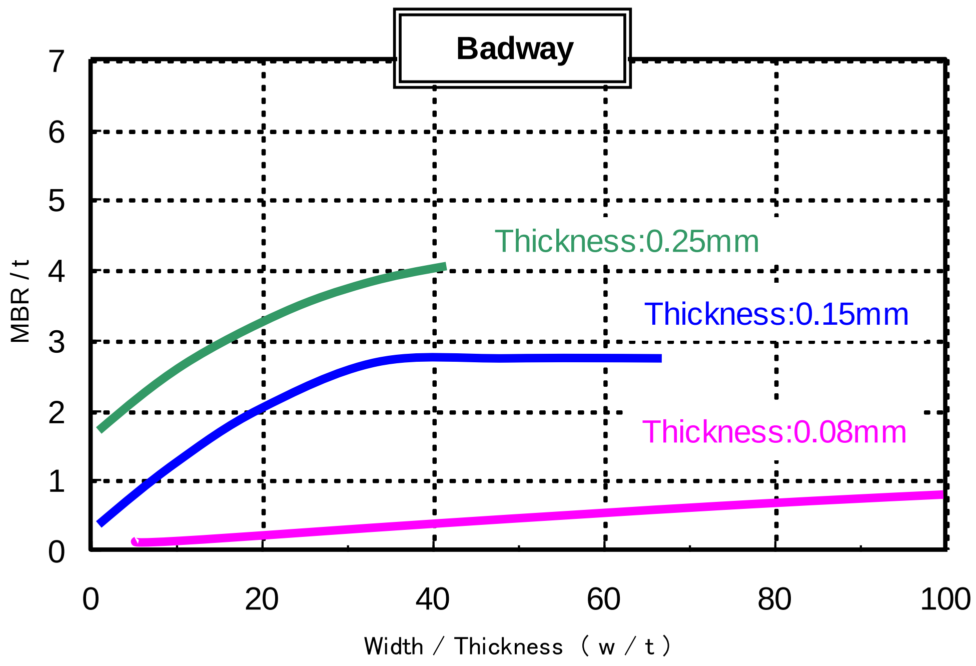
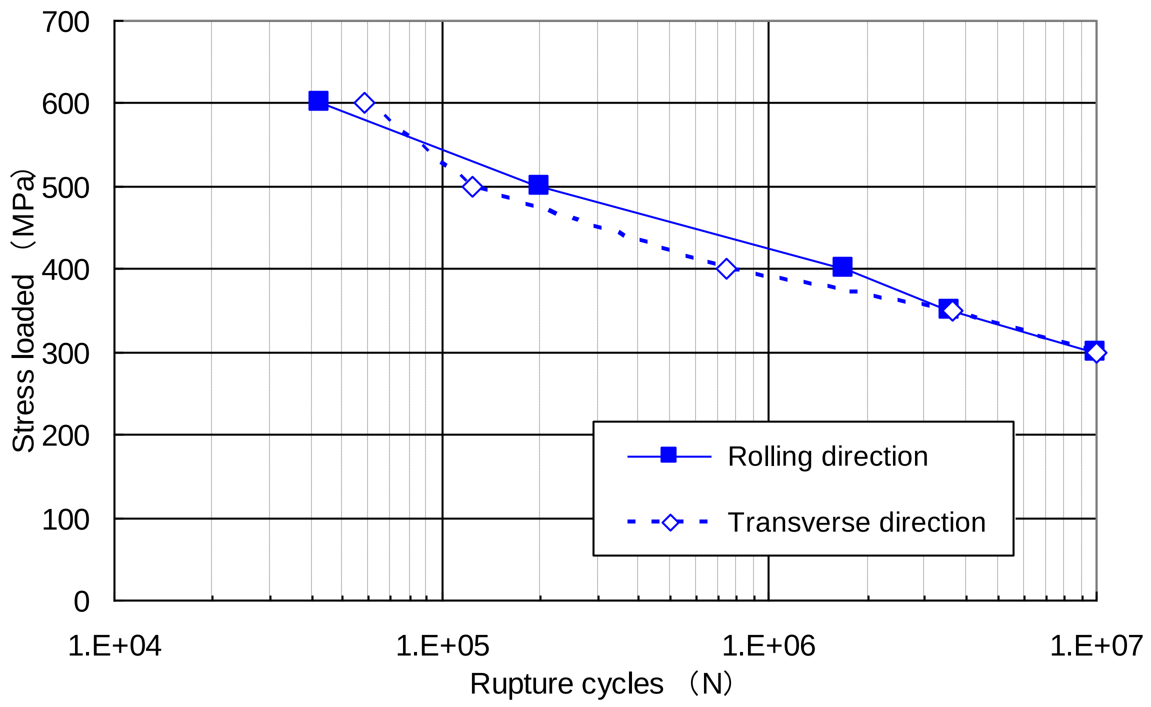


Fig.4 Bend formability variation (bad way) of NKC388-SH in case changing width of specimen.

8. Fatigue Characteristic

Fatigue Characteristic is important when material is used as spring application such as connectors. Fig.3 shows results of fatigue tests. There are no dependence on the direction.



Alloy:NKC388-SH

Amplitude direction : both sides

Size of specimen : 0.15mmt × 10mmw

direction of specimen : Rolling direction = good way, Transverse direction = badway

Testing method : According to JIS-Z-2273

Fig. 5　Comparison of Fatigue Strength

9. Stress Relaxation Resistance

Stress relaxation resistance is highly important for maintaining the contact force for long period of time. Fig.6 shows stress relaxation resistance of NKC388. It is noted that NKC388 maintains over 90% of the initial applied stress at 150 ℃ after 1000hr.

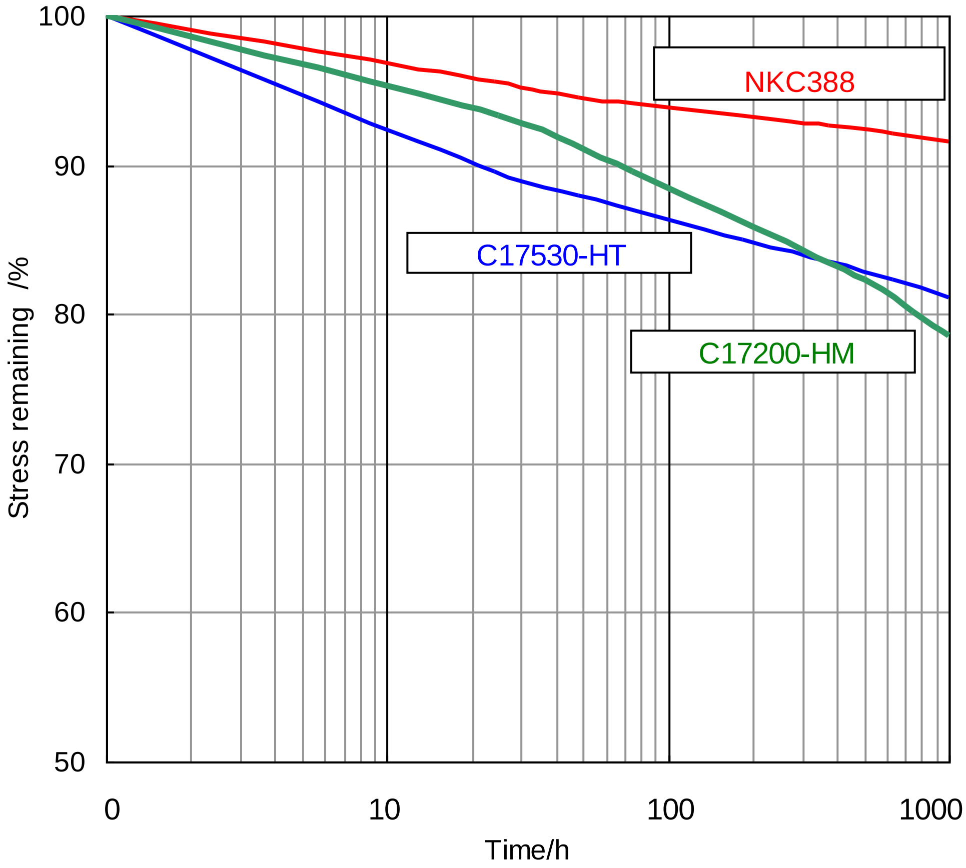


Fig.6 Stress Relaxation Resistance of NKC388
(Temperature: 150℃)

10. Stress-Strain Curve

Fig.7~14 show Stress-Strain curves of NKC388-SH,ESH,XSH and USH.

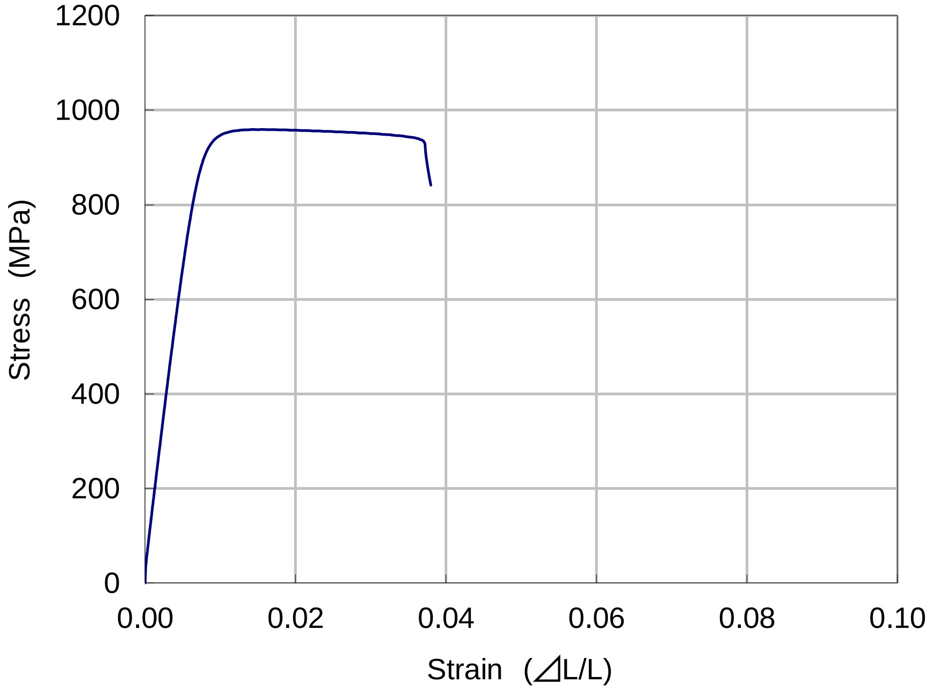


Fig.7　Strain-Stress curve of NKC388－SH (Rolling direction)

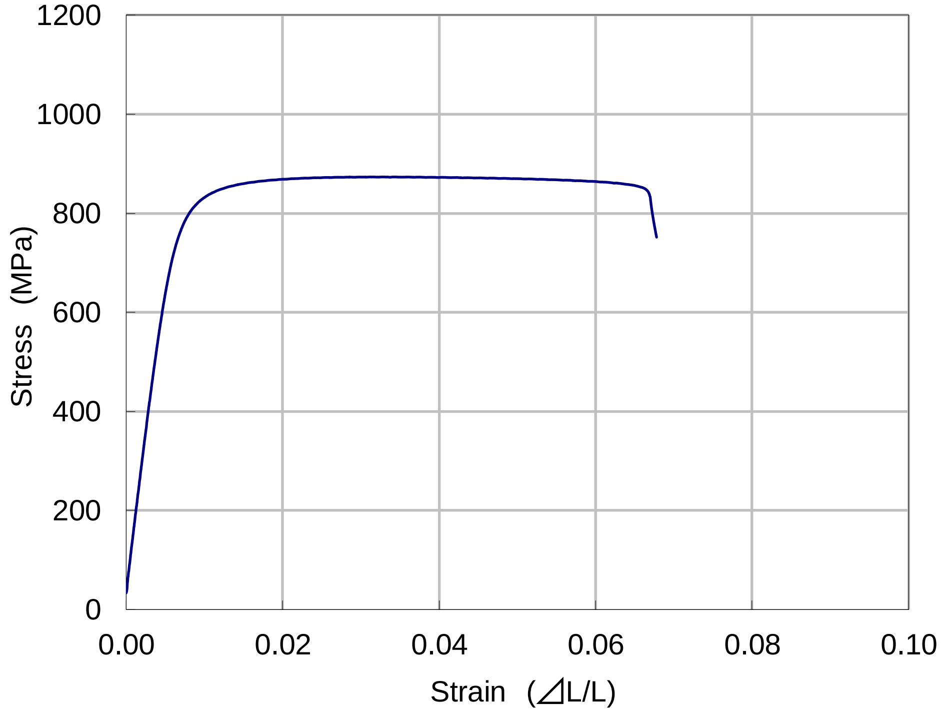


Fig.8　Strain-Stress curve of NKC388－SH (Transverse direction)

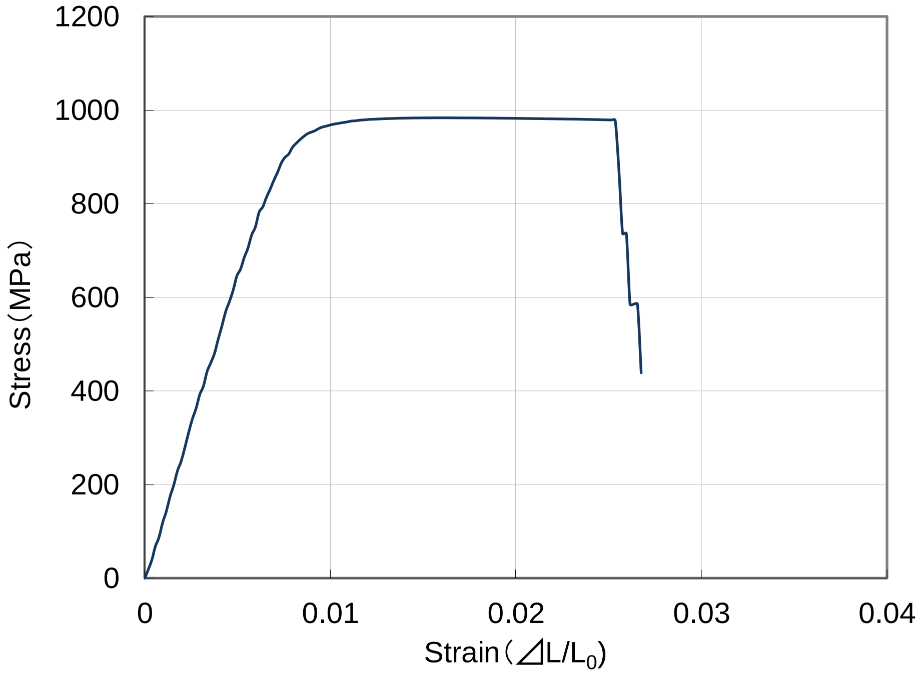


Fig.9　Strain-Stress curve of NKC388－ESH (Rolling direction)

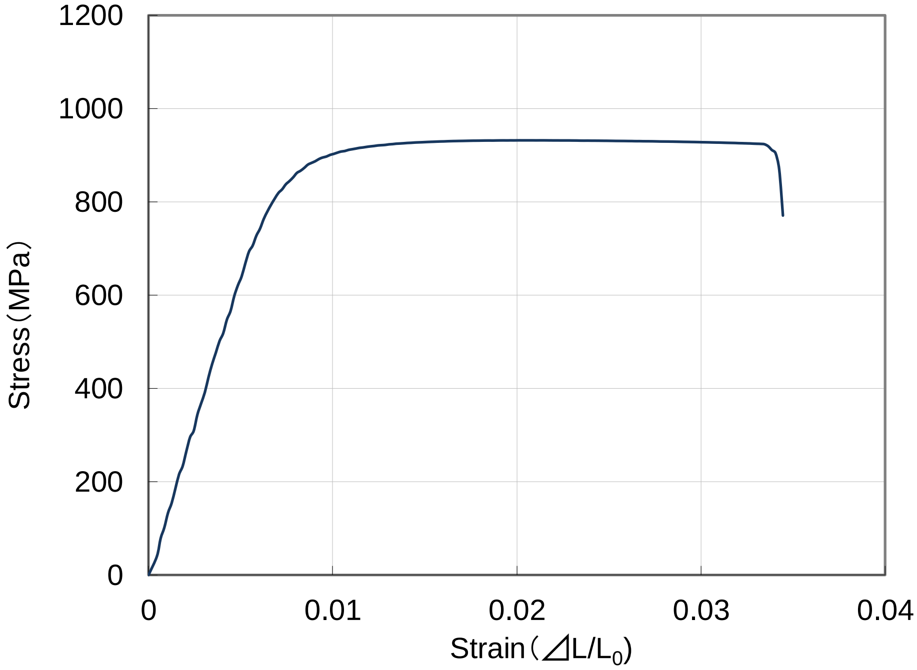


Fig.10　Strain-Stress curve of NKC388－ESH (Transverse direction)

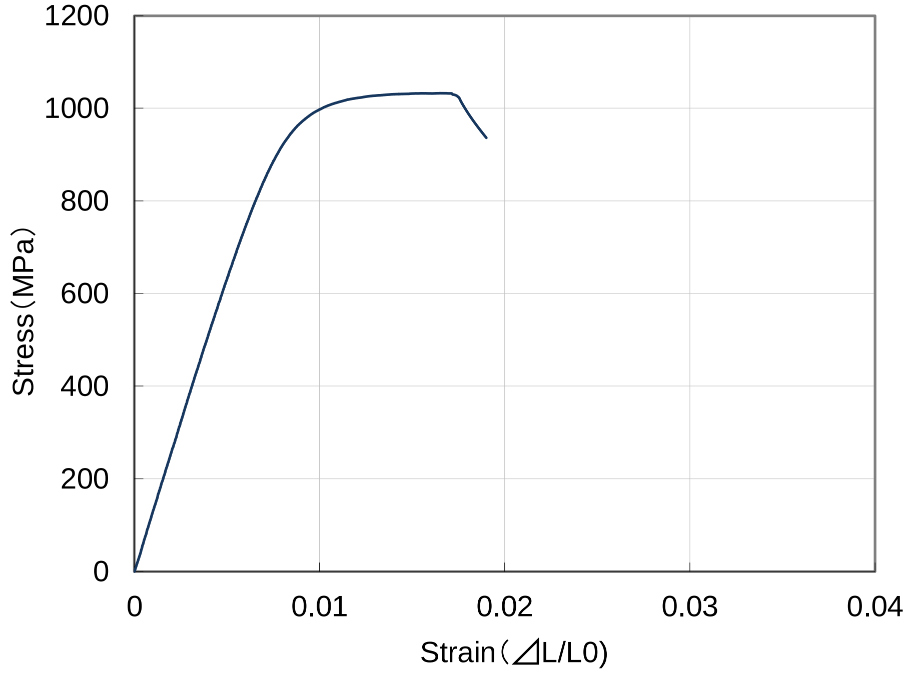


Fig.11 Strain-Stress curve of NKC388－XSH (Rolling direction)

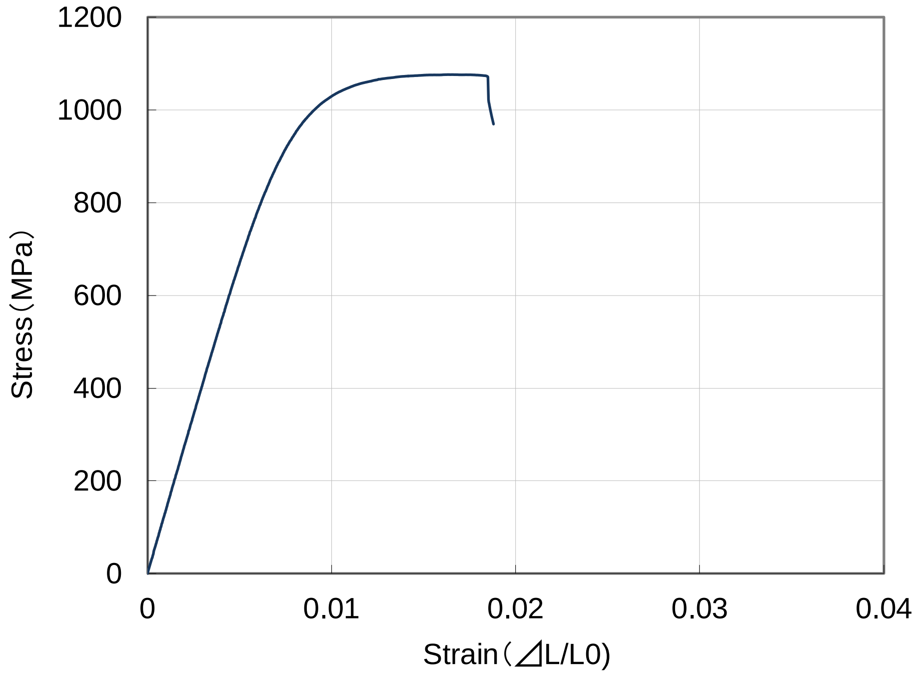


Fig.12 Strain-Stress curve of NKC388－XSH (Transverse direction)

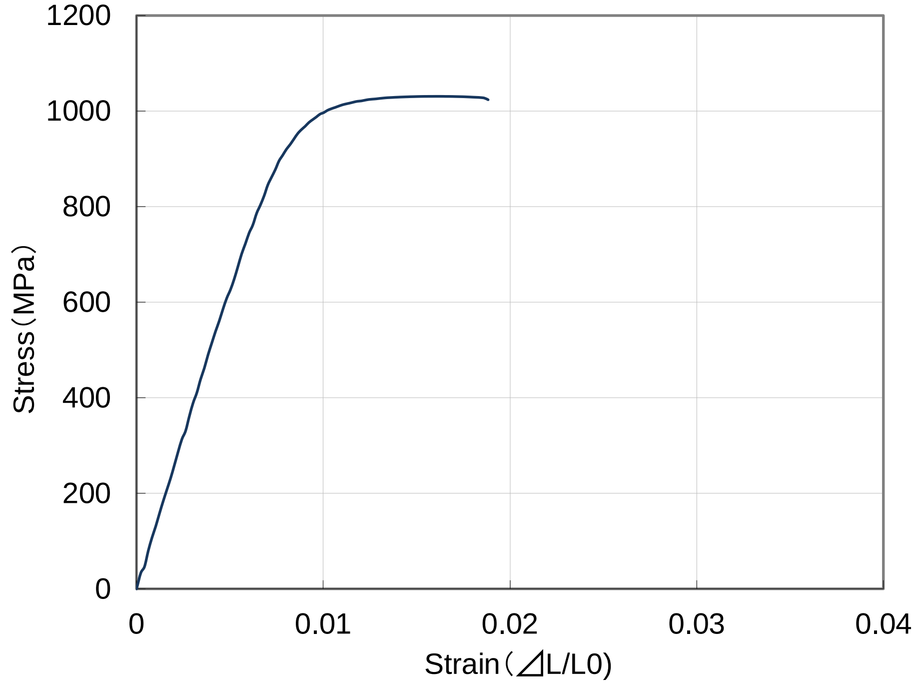


Fig.13　Strain-Stress curve of NKC388－USH (Rolling direction)

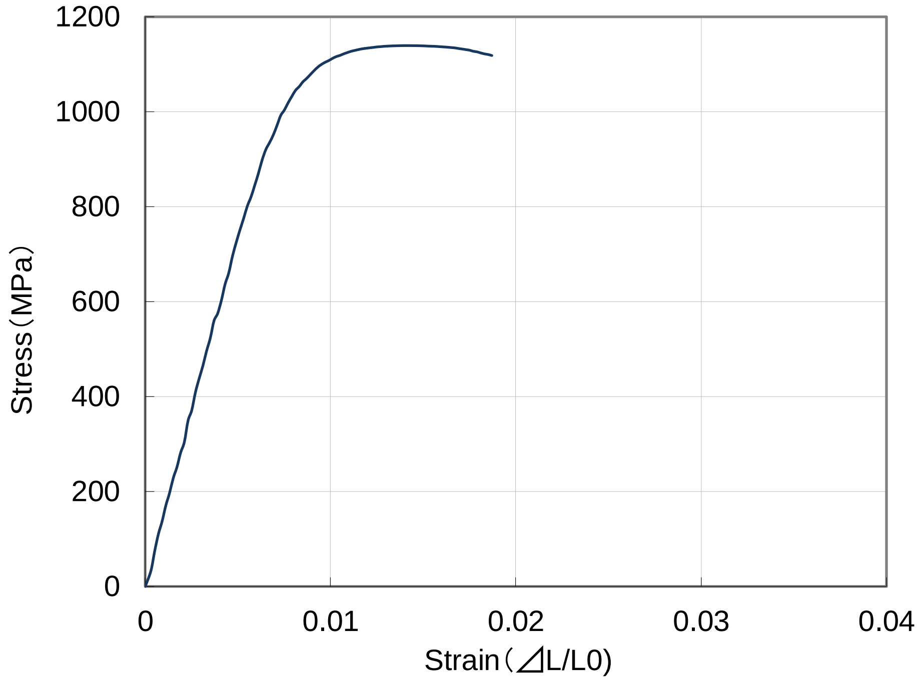


Fig.14　Strain-Stress curve of NKC388－USH (Transverse direction)

＜Further Information＞

JX Nippon Mining & Metals Corporation
Electronic Materials Group
Functional Material Division
Rolled & Fabricated Products Dept.
1-2, Otemachi1-chome, Chiyoda-ku, Tokyo 100-8164 JAPAN
Phone ：+81－3－6257－7421
Fax ：+81－3－6213－3612

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