Support Data for Backward Compatibility

Data for Chip Aluminum Electrolytic Capacitors

Difference of Adherence Intensity by Reflow Temperature

No difference was seen between Pb-free and Pb-contained at the tested reflow temperature conditions

Adherence intensity at each condition（Using φ10×10L, Average of 10 pcs.）

Plating type	Kind of solder	Reflow condition (Temperature at terminal)						
		220℃	223℃	227℃	230℃	239℃	245℃	250℃
Present CP wire Sn-Pb	Eutetic solder Sn-37Pb	127N	127N	127N	118N	108N	108N	108N
	Lead-free solder Sn-3.0Ag-0.5Cu	127N	127N	127N	118N	108N	108N	108N
Lead-free CP wire Sn-Bi	Eutetic solder Sn-37Pb	127N	127N	127N	127N	118N	108N	108N
	Lead-free solder Sn-3.0Ag-0.5Cu	127N	127N	127N	127N	118N	118N	108N

Method of examination : **Based on JIS C 0051（Adherence intensity）**
Reflow system : **TAMURA Corp. Air Reflow System TAS30 - 30DH**
Base Material : **Woven glass fabric epoxy resin copper-clad laminate**
Base size : **$100^{L}\times 40^{W}\times 1.6^{t}$mm（Based on EIAJ RC2363 - 2）**

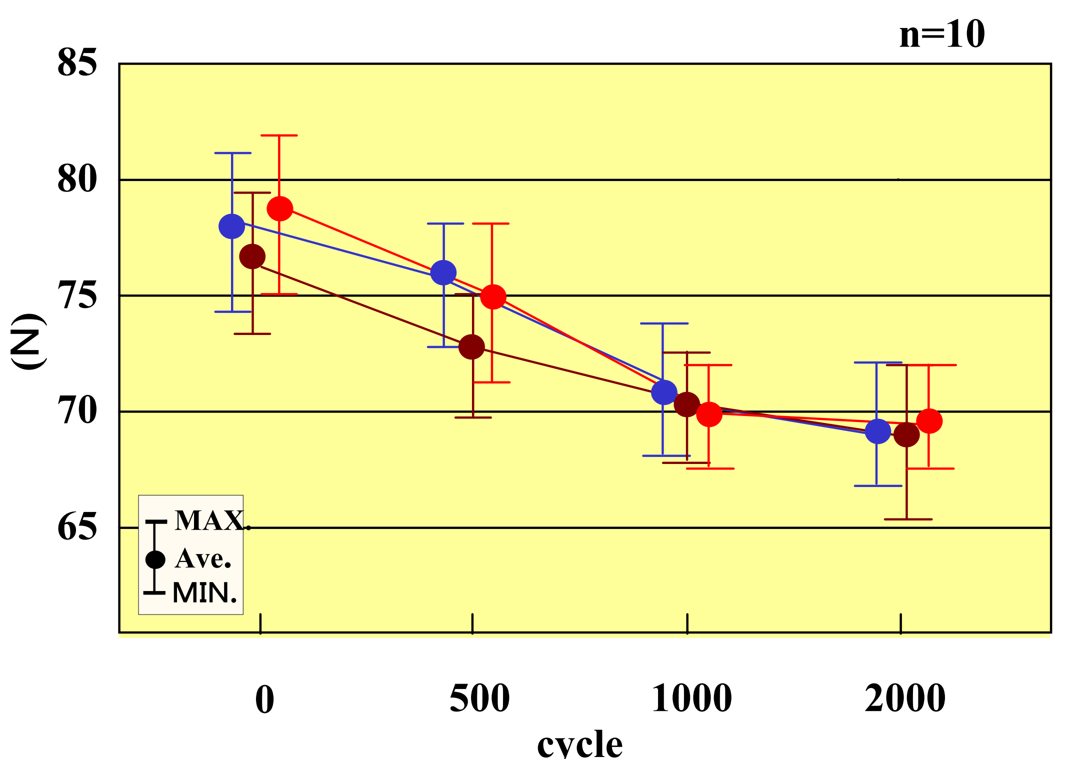
Adherence intensity after thermal shock test

No significant difference in adherence intensity between "eutectic solder" and "lead-free solder" was seen at the tested temperature
The adherence intensity was kept more than 60 N after thermal shock test

●Adherence intensity after thermal shock test

Condition：-55℃⇔ +105℃ 30 min. respectively, 500, 1000, 2000 cycle

Results of adherence intensity test



Sn-Pb plating Sn-37Pb solder
Sn-Bi plating Sn-37Pb solder
Sn-Bi plating Sn-3.0Ag-0.5Cu solder

Method :Based on JIS C 0051 (Adherehce intensity)
Thickness of applied solder : 150 μ m
Terminal :0.24mm pressed terminal
(Made from ϕ 0.45 CP wire)
Reflow condition :

For Sn-37Pb solder
Peak temp. 230℃, duration of over 200℃ : 20 s
For Sn-3.0Ag-0.5Cu solder
Peak temp. 250℃, duration of over 230℃ : 30 s

- **Shear strength / Chip type**

Test standard : JIS C 0051

Reflow soldering profile :

Peak temperature ;230°C ,above 200°C ; 20sec for Sn-37Pb Solder
Peak temperature ;250°C 5sec, above 230°C 30sec for Sn-3.0Ag-0.5Cu Solder

A

B

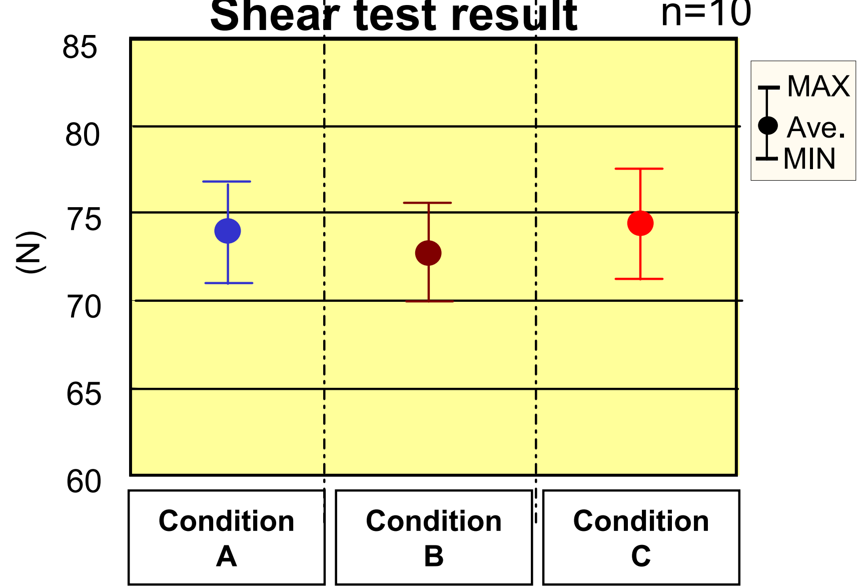
Solder paste thickness : 150μm

Lead wire diameter (original) : D= 0.45mm

Cross section photograph of solder joint

	A	B
Condition A		
Condition B		
Condition C		

Condition A :Sn-Pb finish Sn-37Pb solder
Condition B :Sn-Bi finish Sn-37Pb solder
Condition C :Sn-Bi finish Sn-3.0Ag-0.5Cu solder



No significant difference was seen.
All the solder joints have enough shear strength.

Shear strength after Temperature Cycling

• Shear strength/ Chip type / Reliability (1)

Reliability test condition :

Temperature cycle ; -55°C /+105°C for 30 minute each ; 500, 1000, 2000 cycles

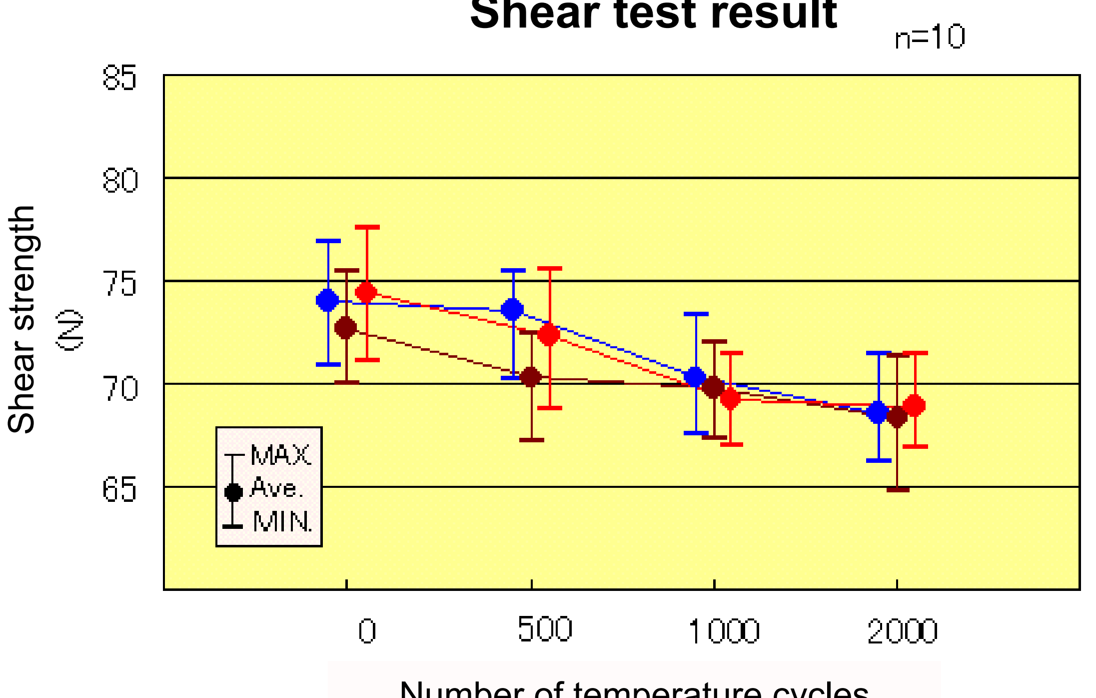
Test standard : JIS C 0051

Reflow soldering profile :

Peak temperature ;230°C ,above 200°C ; 20sec for Sn-37Pb Solder
Peak temperature ;250°C 5sec, above 230°C 30sec for Sn-3.0Ag-0.5Cu Solder

Solder paste thickness : 150μm

Lead wire diameter (original) : D= 0.45mm



- Sn-Pb finish Sn-37Pb solder
- Sn-Bi finish Sn-37Pb solder
- Sn-Bi finish Sn-3.0Ag-0.5Cu solder

No significant Deterioration difference in shear strength of solder joint.

• Shear strength / Chip type / Reliability (2)

Reliability test condition:

High temperature storage at 105°C for 500, 1000, 3000h

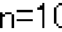
Test standard : JIS C 0051

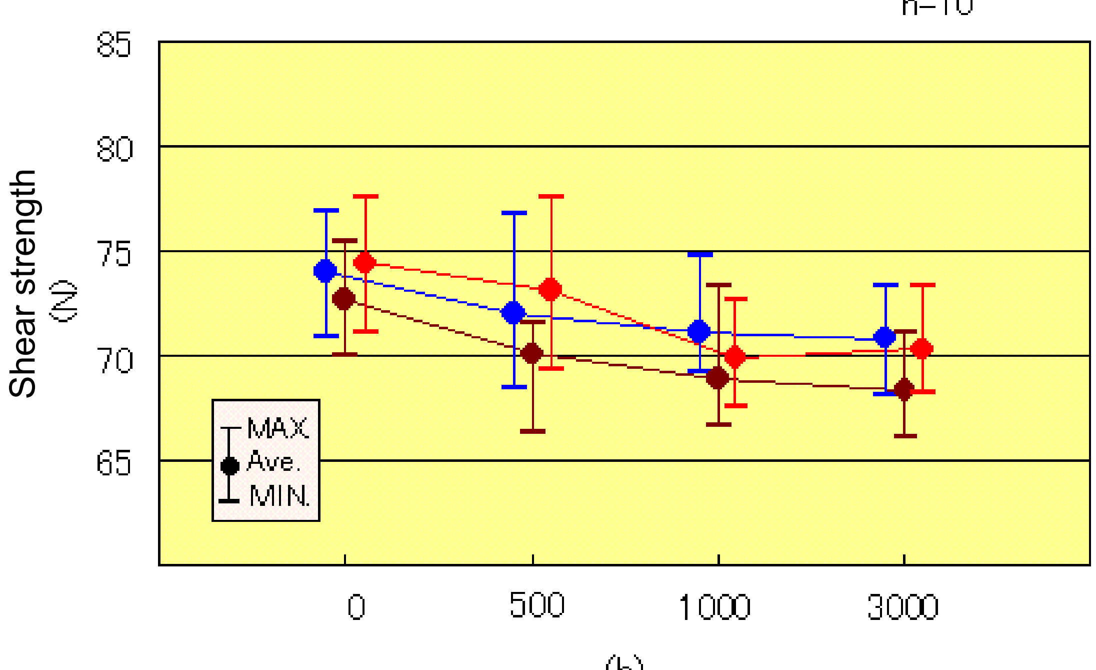
Reflow soldering profile :

Peak temperature ;230°C ,above 200°C ; 20sec for Sn-37Pb Solder
Peak temperature ;250°C 5sec, above 230°C 30sec for Sn-3.0Ag-0.5Cu Solder

Solder paste thickness : 150μm

Lead wire diameter (original) : D= 0.45mm





- Sn-Pb finish Sn-37Pb solder
- Sn-Bi finish Sn-37Pb solder
- Sn-Bi finish Sn-3.0Ag-0.5Cu solder

No significant Deterioration difference in shear strength of solder joint.

• Shear strength / Chip type / Reliability (3)

Reliability test condition :

PCT(Pressure cooker test) ; 105°C, 100RH% for 120, 250h

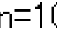
Test standard : JIS C 0051

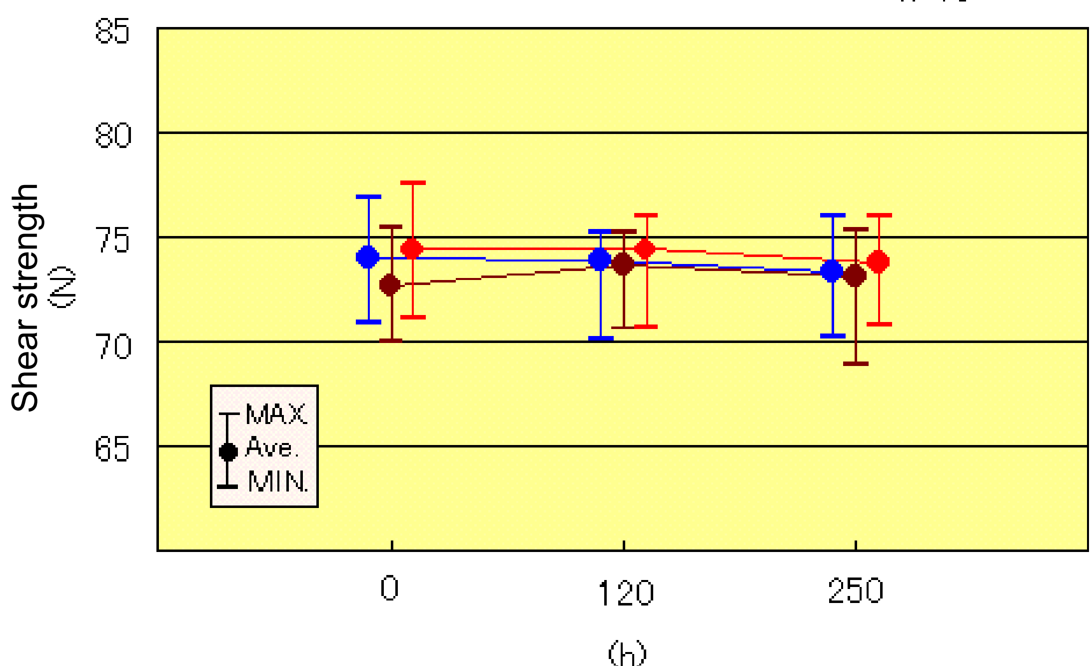
Reflow soldering profile :

Peak temperature ;230°C ,above 200°C ; 20sec for Sn-37Pb Solder
Peak temperature ;250°C 5sec, above 230°C 30sec for Sn-3.0Ag-0.5Cu Solder

Solder paste thickness : 150μm

Lead wire diameter (original) : D= 0.45mm





●	Sn-Pb finish	Sn-37Pb solder
●	Sn-Bi finish	Sn-37Pb solder
●	Sn-Bi finish	Sn-3.0Ag-0.5Cu solder

No significant Deterioration difference in shear strength of solder joint.

Data for Miniature Aluminum Electrolytic Capacitors and Lead-wire Type Film Capacitors

Solderability

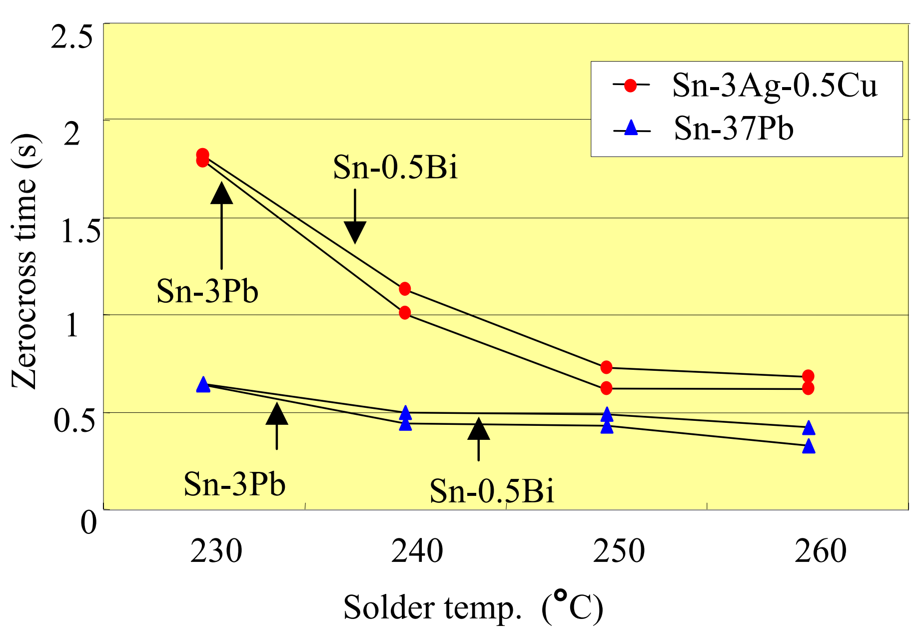
- **Solderability of lead wire**

Wetting balance method using non-activated flux

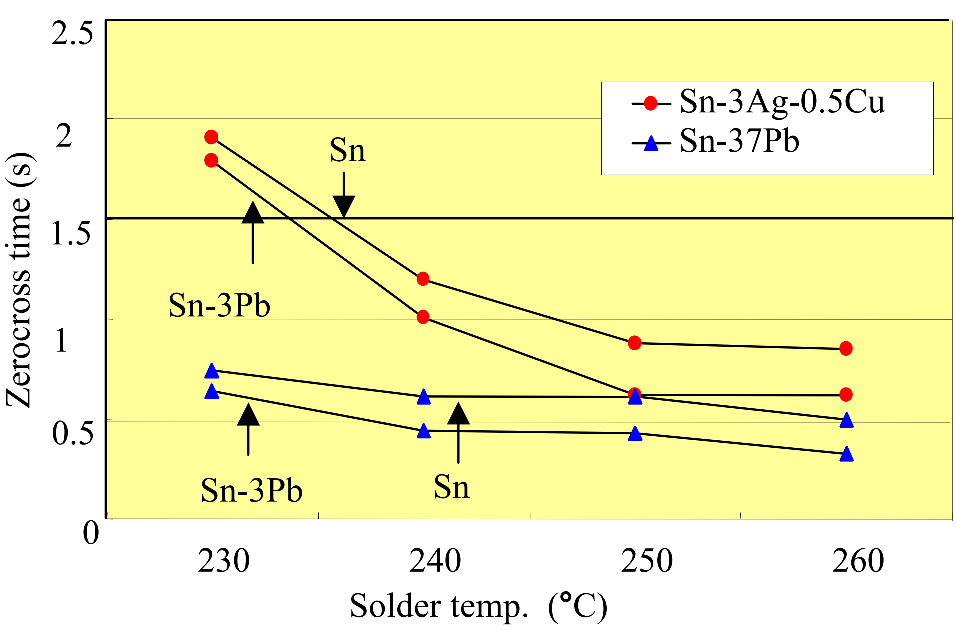
PCT treatment : 105°C 100%RH 4h

No Significant difference was seen in both Zerocross time comparison of Sn-3Pb finished lead-wire With Sn-0.5Bi and Sn

- **Sn-Bi finish (D= 0.6)**

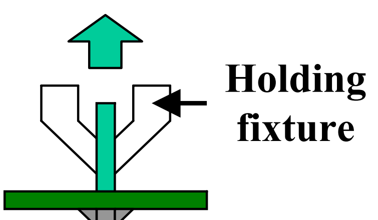


- **Sn finish (D= 0.6)**



Tensile strength

- **Tensile strength / Lead wire type**

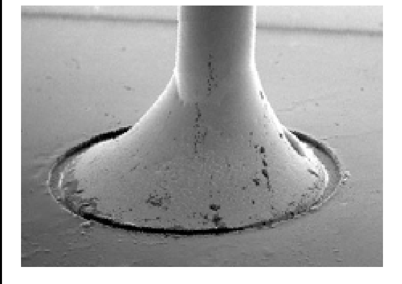


Test condition :

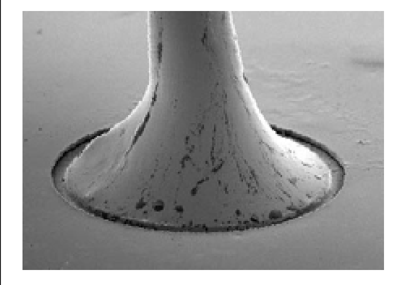
Pull Speed - 20 mm / minute
Samples - 10 pcs. / each
Solder Bath temperature - 230°C for Sn-37Pb solder
245°C for Sn-3.0Ag-0.5Cu solder
Lead wire diameter - 0.6 mm

SEM photograph of solder joint

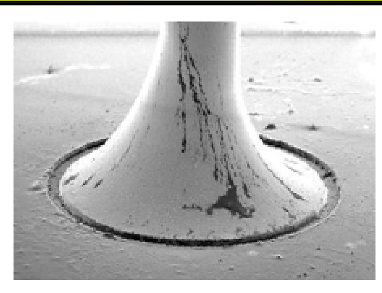
Sn-Pb finish Sn-37Pb solder



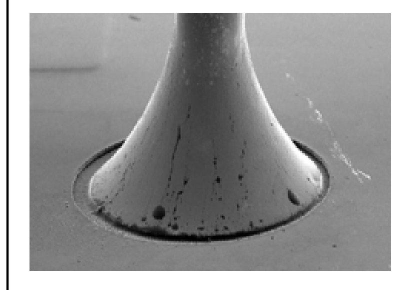
Sn-Pb finish Sn-3.0Ag-0.5Cu solder



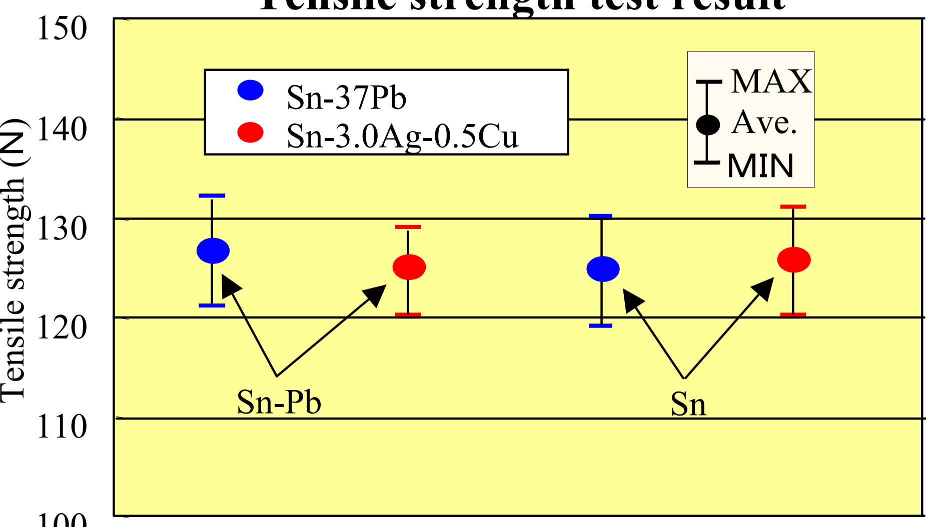
Sn finish Sn-37Pb solder



Sn finish Sn-3.0Ag-0.5Cu solder



Tensile strength test result



No difference was seen between Pb-free and Pb-contained solder joint, which was not damaged during the test. The lead-wires were broken down.

Tensile strength after Temperature Cycle

• Tensile strength / Lead wire type / Reliability (1)

Reliability test condition :

Temperature cycle ; -55°C /+105°C for 30 minute each ; 500,1000,2000 cycles

Test condition : Pull Speed ; 20 mm / minute

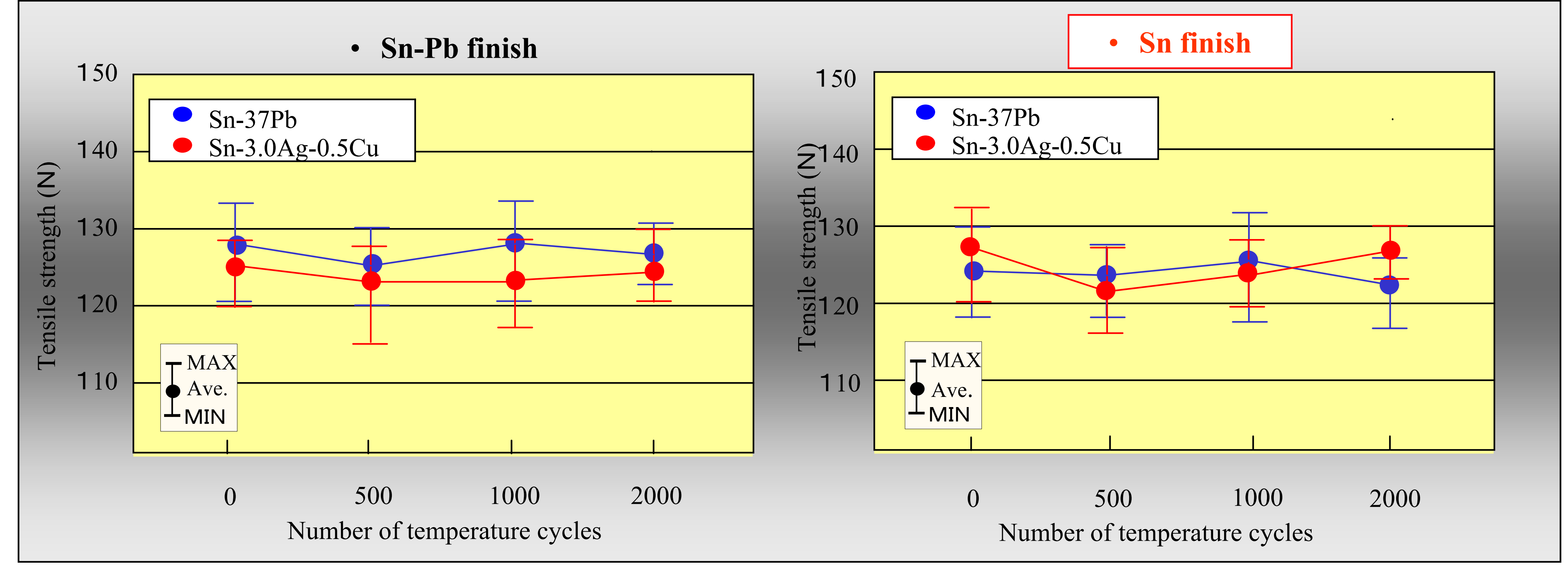
Solder Bath temperature : 230°C for Sn-37Pb solder

245°C for Sn-3.0Ag-0.5Cu solder

Lead wire diameter : D= 0.6 mm

No significant Deterioration difference in tensile strength of solder joint.

Tensile strength result



Tensile strength after High Temperature Storage

• Tensile strength / Lead wire type / Reliability (2)

Reliability test condition:

High temperature storage at 105°C for 500,1000,3000h

Test condition : Pull Speed ; 20 mm / minute

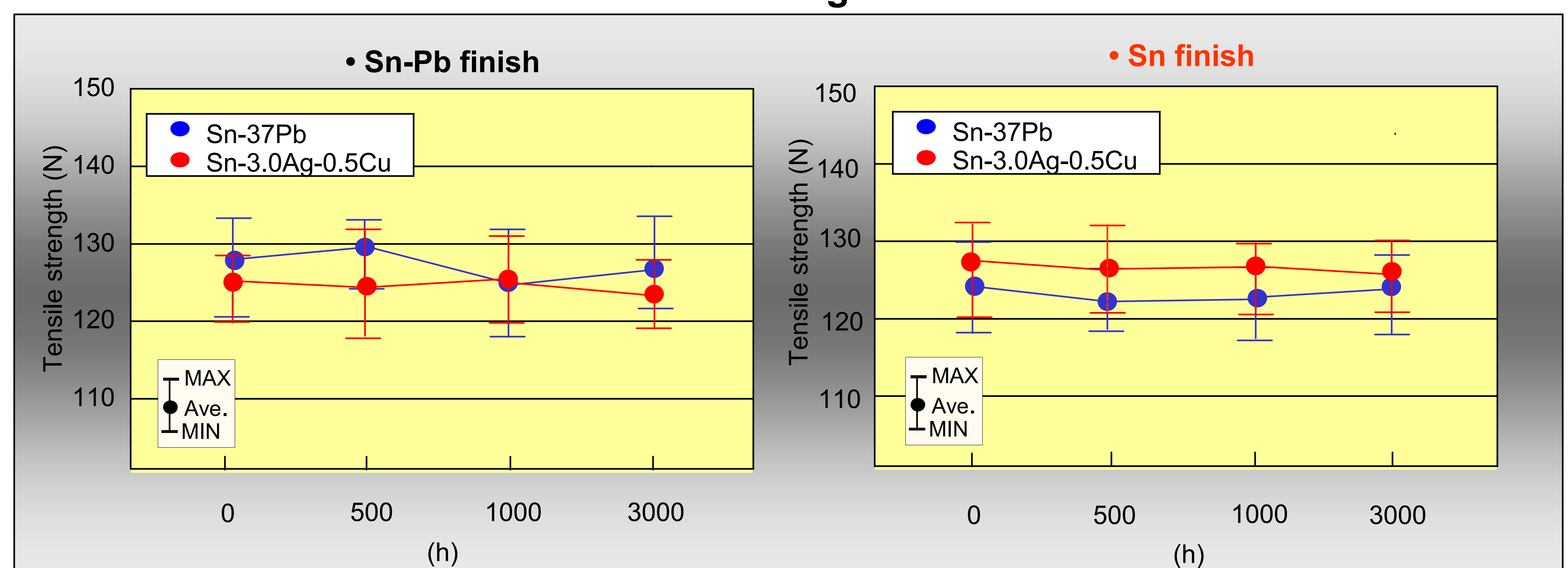
Solder Bath temperature : 230°C for Sn-37Pb solder

245°C for Sn-3.0Ag-0.5Cu solder

Lead wire diameter : D= 0.6 mm

No significant Deterioration difference in tensile strength of solder joint.

Tensile strength result



Tensile strength after Pressure Cooker Test

- **Tensile strength / Lead wire type / Reliability (3)**

Reliability test condition :

PCT(Pressure cooker test) ; 105°C, 100RH% for 120, 250h

Test condition : Pull Speed ; 20 mm / minute

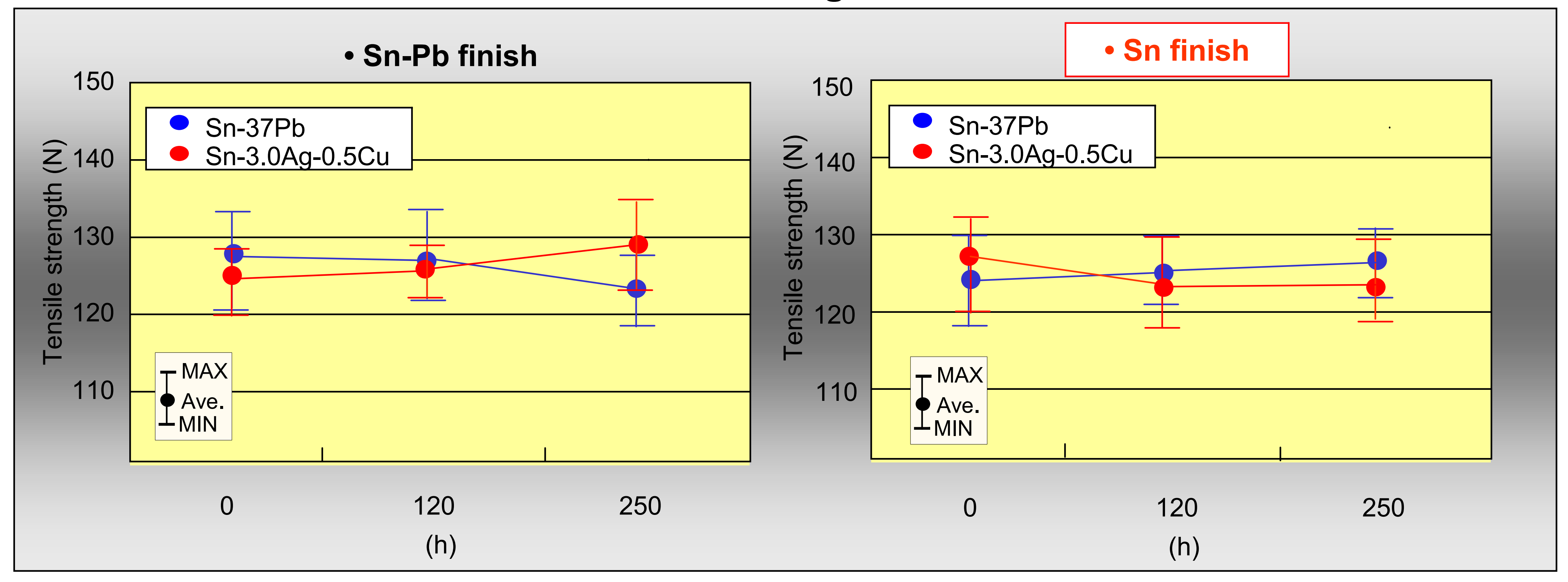
Solder Bath temperature : 230°C for Sn-37Pb solder

245°C for Sn-3.0Ag-0.5Cu solder

Lead wire diameter : D= 0.6 mm

No significant Deterioration difference in tensile strength of solder joint.

Tensile strength result



Data for Large Can Aluminum Electrolytic Capacitors

Solderability

Test condition

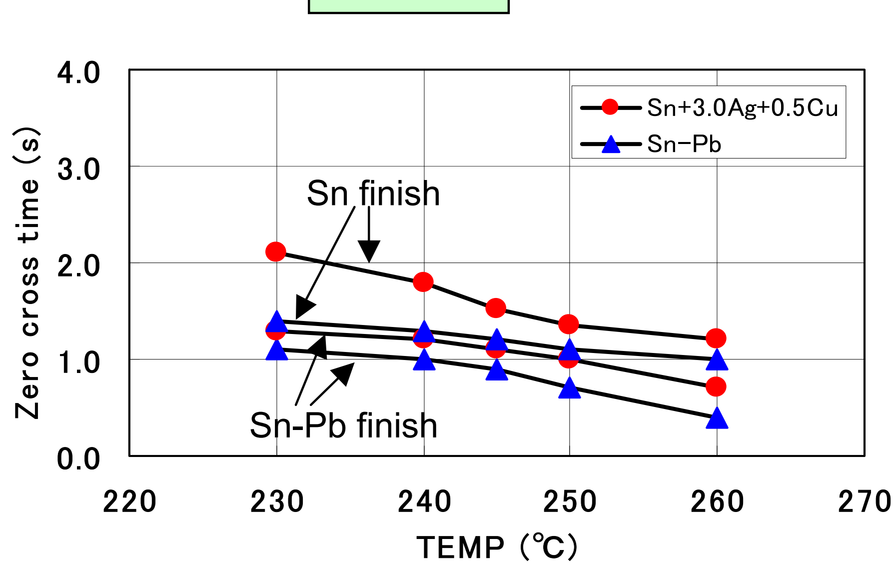
1. Measuring instrument : Solder checker by RESCHA
2. Treatment : PCT(105℃/100%R.H. 8hours)
3. Solder bath temp. : 230℃, 240℃, 250℃, 260℃
   (Flux : Tamura-kaken NA-200 ethanol)

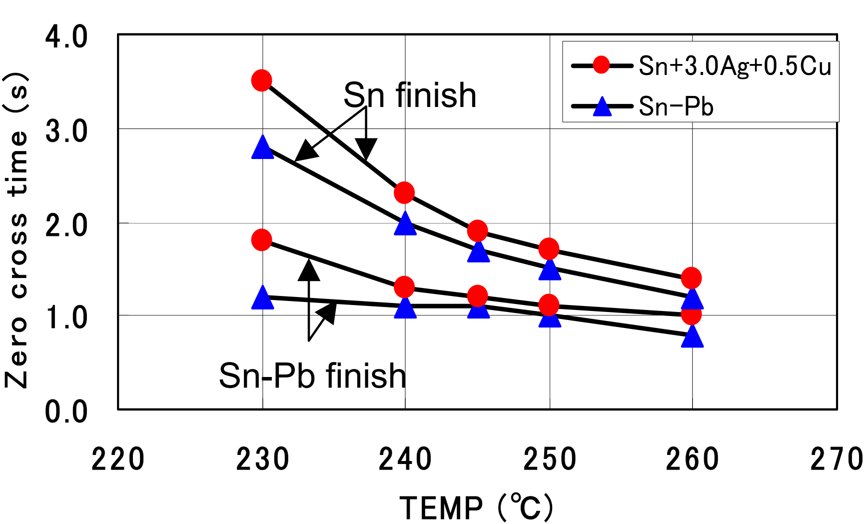
Comparing Sn 100% finished with Sn-Pb finished terminal

No Significant difference was seen in the test

Solder

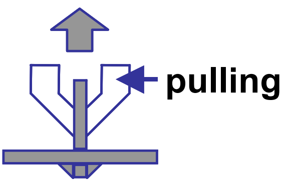
(1) Sn - Pb (JIS:H60A)
(2) Sn - 3.0Ag - 0.5Cu (Senju Metal Industry Co., Ltd.)





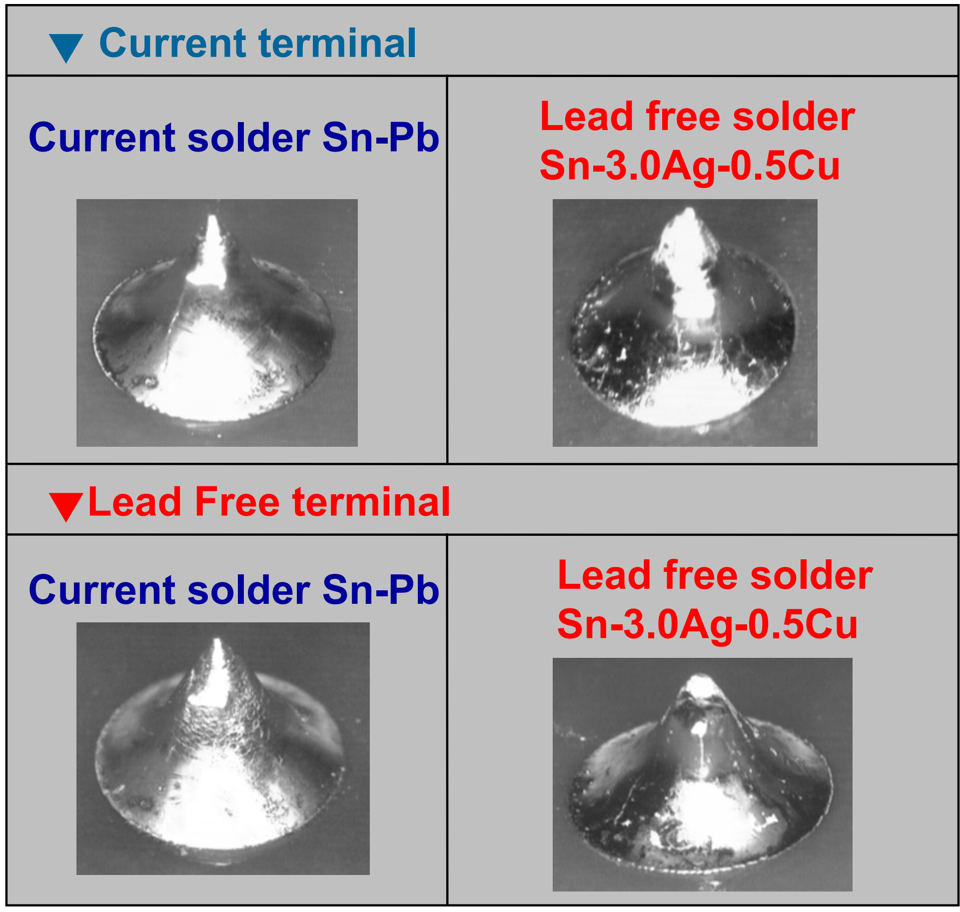
Tensile strength

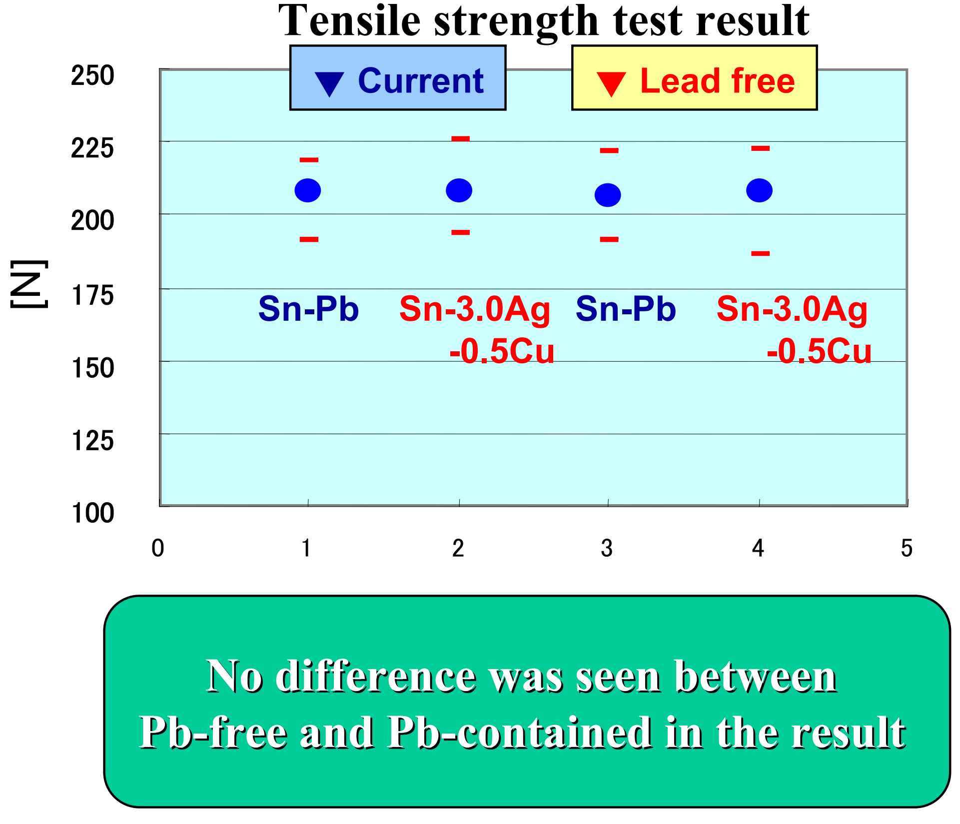
• Tensile strength / Lead wire type



Test condition :

Pull Speed - 20 mm / minute
Solder Bath temperature - 230°C for Sn-37Pb solder
245°C for Sn-3.0Ag-0.5Cu solder





No difference was seen between
Pb-free and Pb-contained in the result

Fixedness strength

• Tensile strength / Lead wire type / Reliability (1)

Reliability test condition :

Temperature cycle ; -55°C /+105°C for 30 minute each ; 500,1000 cycles

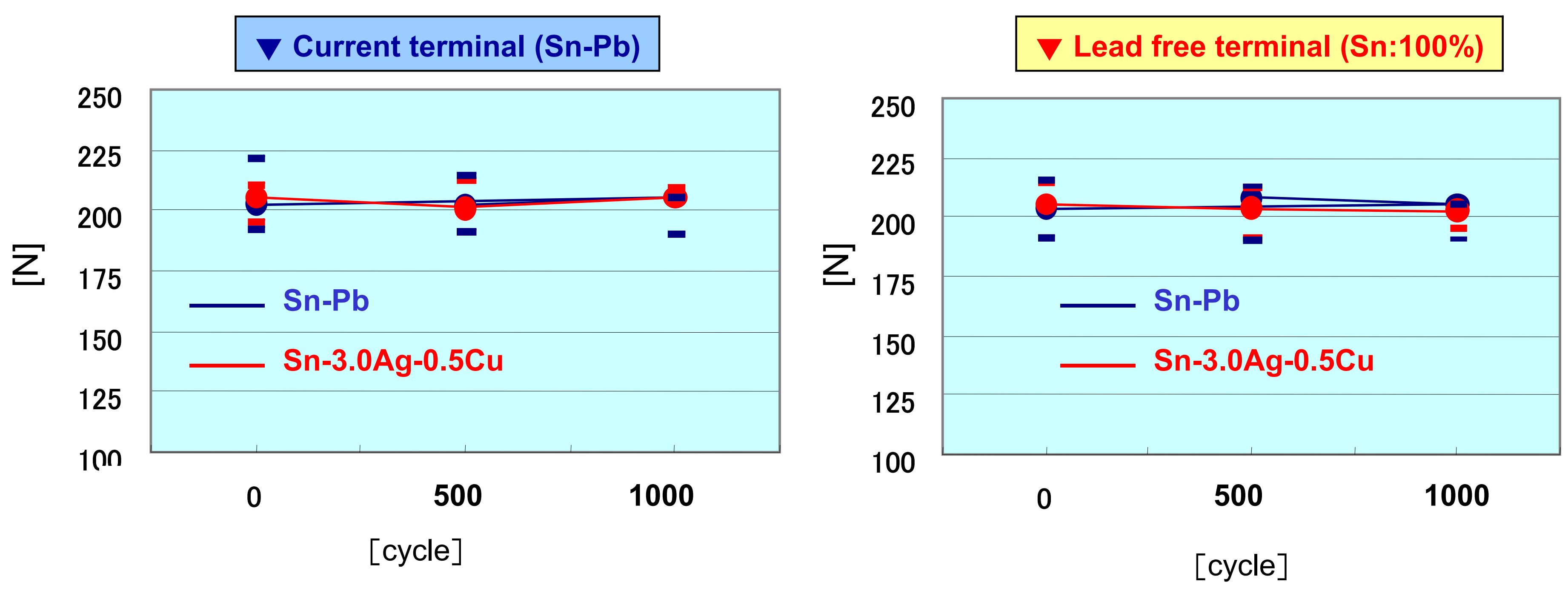
Test condition : Pull Speed ; 20 mm / minute

Solder Bath temperature : 230°C for Sn-37Pb solder

245°C for Sn-3.0Ag-0.5Cu solder

No significant Deterioration difference in tensile strength of solder joint.

Tensile strength result



Tensile strength after Temperature Cycle

• Tensile strength / Lead wire type / Reliability (2)

Reliability test condition:

PCT(Pressure cooker test) ; 105° C, 100RH% for 120, 250h

Test condition: Pull Speed ; 20 mm / minute

Solder Bath temperature : 230°C for Sn-37Pb solder

245°C for Sn-3.0Ag-0.5Cu solder

No significant Deterioration difference in tensile strength of solder joint.

Tensile strength result