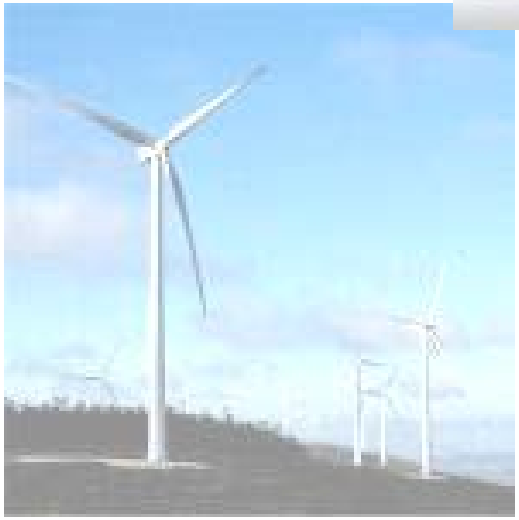
Patented by Panasonic

T/C stress resistant high reliability solder alloy

SB6NX / SB6N

Sn 3.5Ag 0.5Bi 6.0In 0.8Cu　　**Sn 3.5Ag 0.5Bi 6.0In**



KOKI

SB6NX & SB6N solder alloy

- SB6NX alloy is Panasonic patented
- Conventional SB6N (Sn3.5Ag0.5Bi6In) alloy revealed that it may not be compatible with Ni-Au plating and cause poor T/C resistance (according to Panasonic).

  The newly introduced SB6N plus Cu alloy solve this compatibility issue with Ni-Au, and ensures good and reliable T/C resistance with the rest of surface finishes as the original SB6N alloy.

SIEMENS

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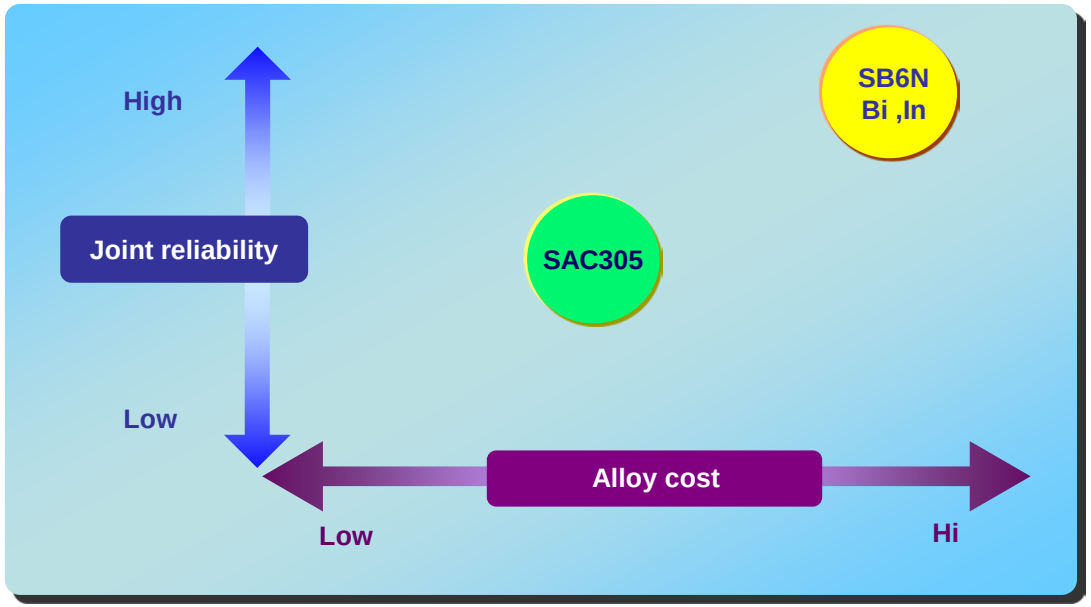
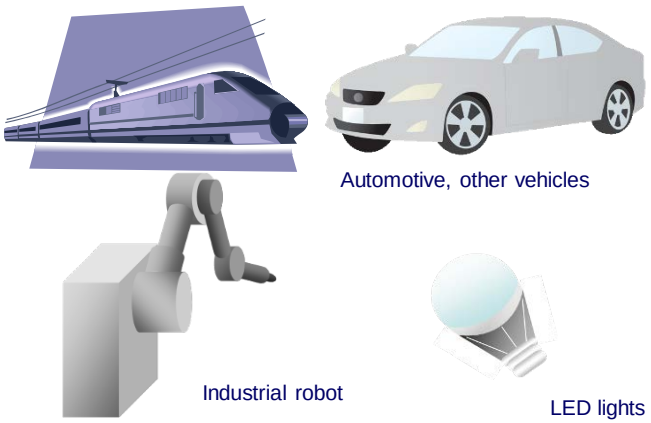
Nidec
-All for dreams

SB6NX & SB6N solder alloy

- **Higher mechanical strength than SAC305!**
- **Higher thermal cycling stress resistance than SAC305!**

With the addition of property improvement/modifying metal elements (Bi, Ni, In), Koki's "high reliability solder alloys" are designed and intended to achieve superior joint strength. This is in both mechanical and thermal cycle stress in comparison to conventional SAC305.





SB6NX & SB6N solder alloy

Metal element	Advantage	Disadvantage
Bi	• Lowers melting point as added amount increases • Increases joint strength • Lowers surface tension and improves wetting	• Forms low melting phase with Pb (Sn46.2/Pb25.1/Bi28.7; Melting point 98ºC) • Makes solder joint brittle → Low resistance to impact
In	• Lower melting point as added amount increases	• Costly • Easily oxidizes as it melts →Poor solder wetting
Sb	• Improves joint strength	• Increases melting point as added amount increases

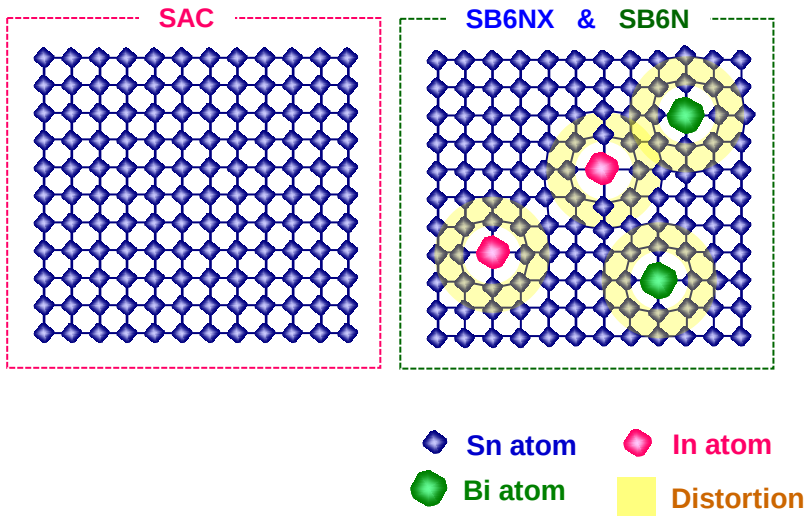
SB6NX & SB6N solder alloy

Solid solution of Sn matrix

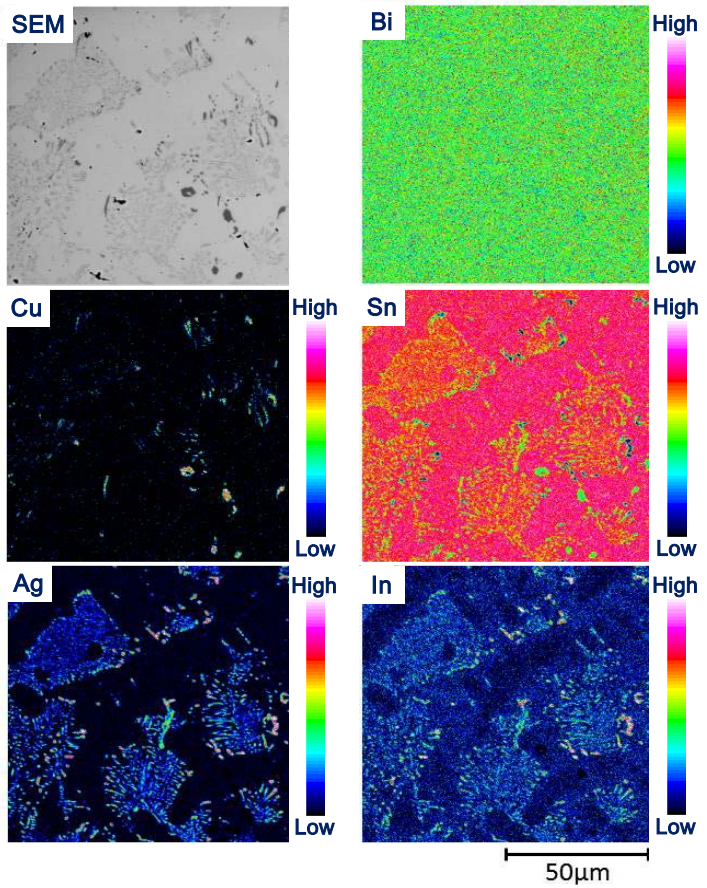
In lead free solder joint, Sn grain becomes coarse due to a dislocation of Sn atom by shear stress when exposed to thermal cycle condition. This causes plastic deformation and finally leads to a fracture of the joint.

SB6NX/SB6N alloy, having **Bi** and **In** which have different atomic radius from Sn, in Sn matrix, effectively inhibit dislocation of Sn atom and, thus, strengthen the joint.

Solid solution model



SB6N SEM-EPMA Mapping after reflow



Cu unevenly distributed in Sn matrix as Cu6Sn5

IMC = Blue, orange

Ag unevenly distributed as an IMC(Ag3Sn・Ag2In)..

IMC = Blue

Bi grain distributed in Sn matrix uniformly.

Bi = Warm color

Sn forms IMC (CU6Sn5, Ag3Sn).

IMC=Orange + green

In distributed in Sn matrix, though some form AgSnIn IMC.

IMC=Light glue, orange

SB6NX & SB6N solder alloy

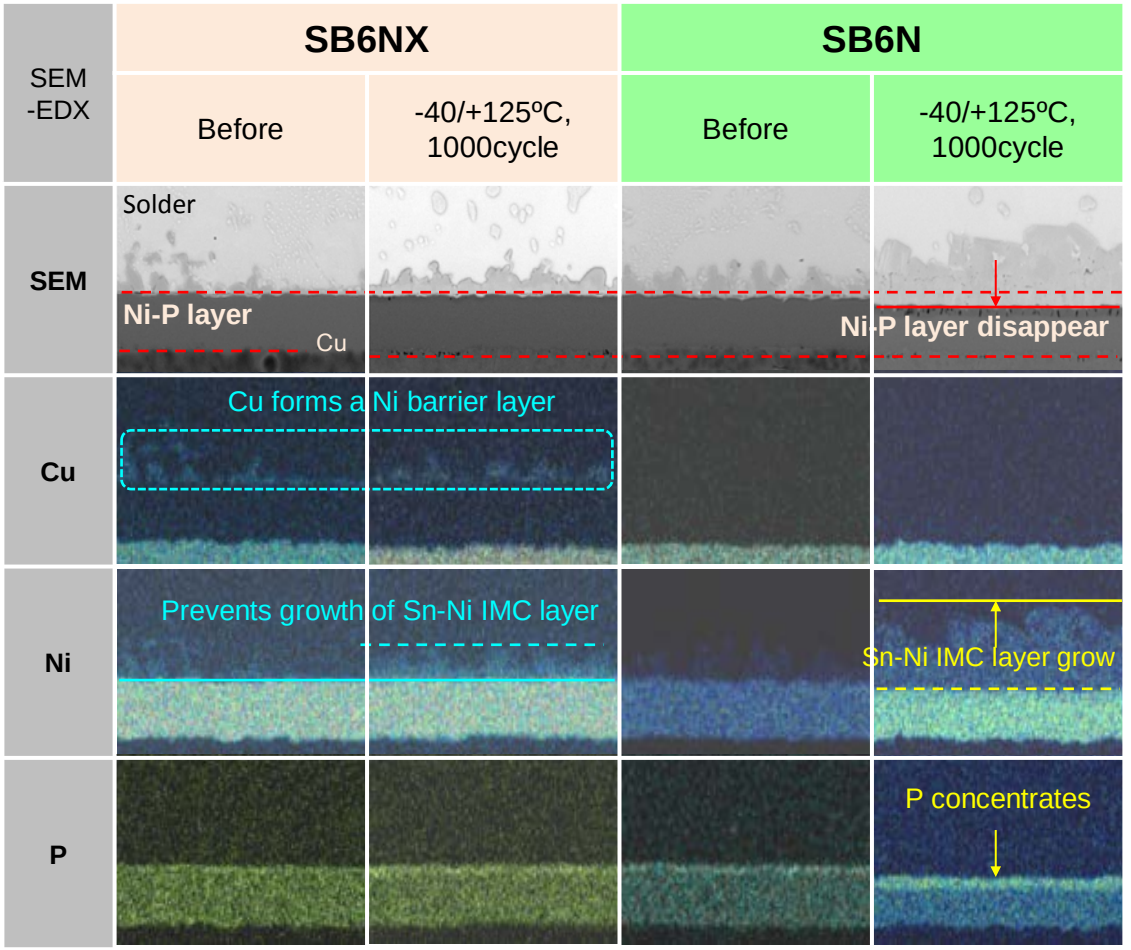
Issue SB6N: Poor compatibility with Au/Ni plating → Low joint reliability

Improvement of compatibility with ENIG finish: SB6NX alloy

Au from ENIG diffuses into the solder quickly. Then, Ni from electroless Ni-P layer diffuses and forms Sn-Ni IMC layer. Ni continue diffuses and thickens Sn-Ni IMC layer. This causes a concentration of P and makes the joint interface brittle.

SB6NX containing Cu, that is quite compatible with Ni, precipitates and forms Cu6Sn5 IMC at the interface with Ni-P. This acts as a Ni barrier layer and effectively prevents the continual diffusion of Ni / thickening of Sn-Ni IMC layer / concentration of P, and realizes high joint reliability with ENIG finish.

■SB6NX & SB6N vs. ENIG



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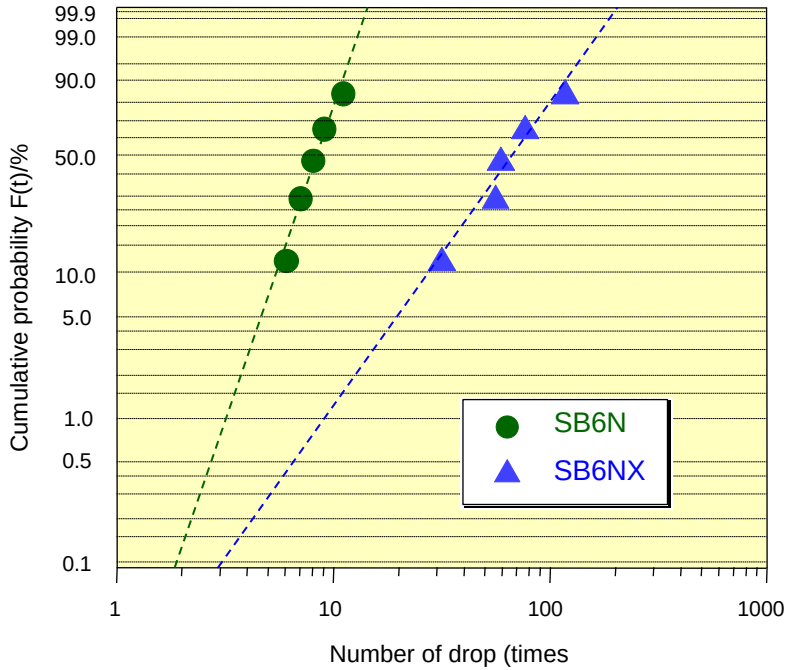
SB6NX & SB6N solder alloy

Drop shock test: ENIG+BGA after 150ºC x 500 hrs aging



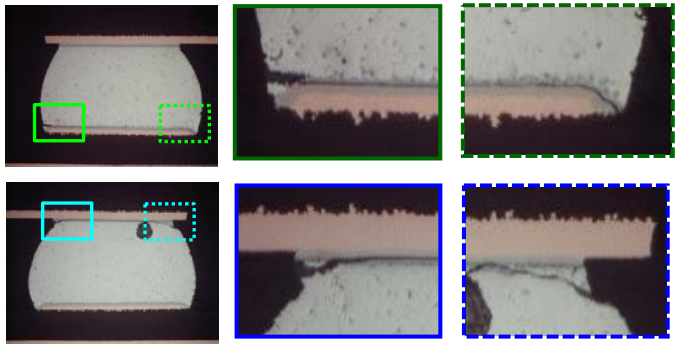
SB6NX indicated 5 times stronger anti-shock resistance than SB6N. SB6N resulted in fracture in-between solder and ENIG substrate, while SB6NX shows fracture in-between solder and package.

*JEDEC JESD22-B111

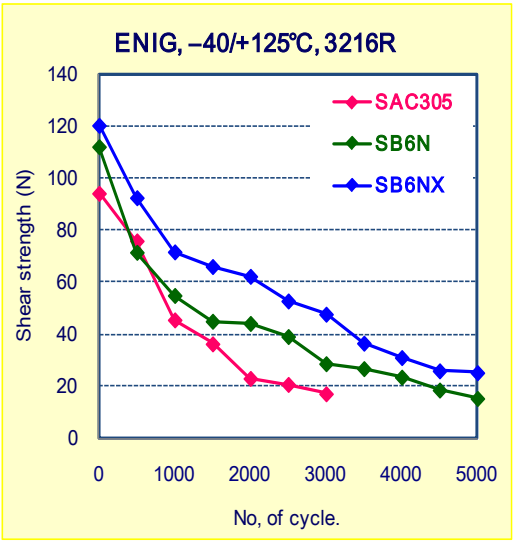
Cross-section after drop shock test

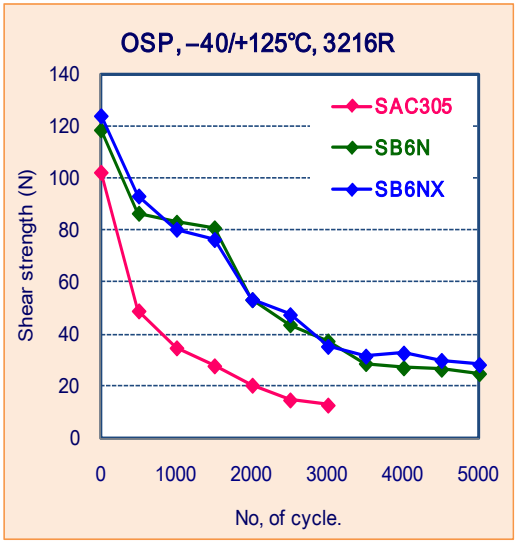
SB6N

SB6NX



Shear strength after T/cC at -40/+125ºC on 3216R





SB6NX ensures as high shear strength as OSP substrate, while SB6N resulted lower strength than SAC305 with ENIG below 1000 cycles.

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SB6NX & SB6N solder alloy

Solder paste

Alloy code	Alloy composition (%)	Product number	Flux type (J-STD-004)	Particle size (μm)
SB6N	Sn 3.5Ag 0.5Bi 6.0In	**SB6N58-M500SI**	ROL0	20-38
SB6NX	Sn 3.5Ag 0.5Bi 6.0In 0.8Cu	**SB6NX58-M500SI**	ROL0	20-38

Flux cored solder wire

Alloy code	Alloy composition (%)	Product number	Flux type (J-STD-004)	Wire diameter (mm)
SB6N	Sn 3.5Ag 0.5Bi 6.0In	**SB6N-72M**	ROL0	0.3-1.6

2 years

of

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