SN100CV®

Save on silver cost and get better reliability

By Keith Sweatman (Nihon Superior) and the DKL Metals Technical Team

As the UK electronics manufacturing sector faces the dual challenges of rising material costs and increasing demands for long-term reliability, DKL Metals is proud to announce the regional rollout of SN100CV®. This silver-free alloy represents a paradigm shift in solder technology, offering a "drop-in" replacement for SAC305 that improves performance while stabilising the supply chain.

Silver-free replacement for Tin-3.0 Silver-0.5 Copper ("SAC305")

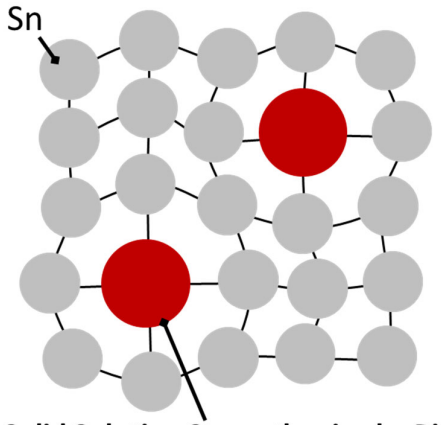
- Strengthening mechanism is more stable than that provided by silver
    - Better long-term reliability
- Reflow with same thermal profile as SAC305
    - Drop-in replacement for SAC305

Built on the globally proven SN100C platform:

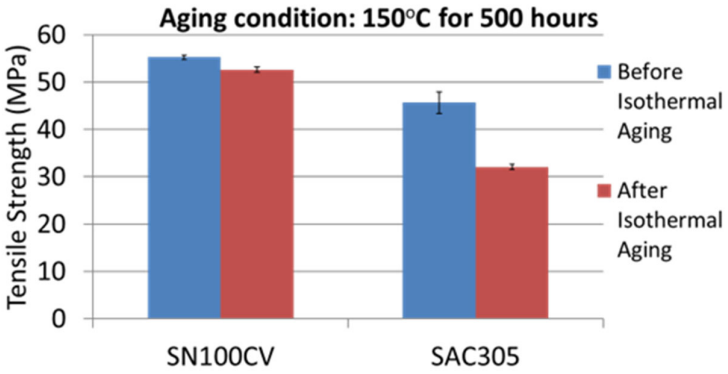
- Ni-promoted high fluidity
- Ni-stabilized hexagonal form of the Cu_6Sn_5 intermetallic compound IMC):
    - Thin, smooth and slow-growing IMC layer
    - No cracking of the IMC layer as a result of hexagonal to monoclinic form of Cu_6Sn_5
    - Low tendency to dissolve copper substrates even after long exposure to the molten alloy

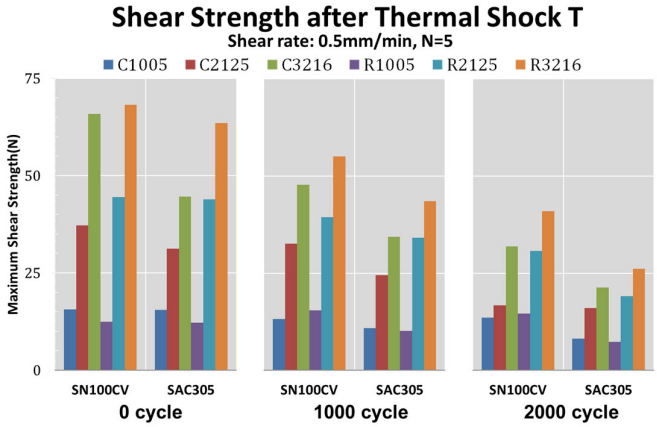
<u>Stable</u> strengthening mechanism

- SN100CV reliability is delivered by the stable mechanism of **solid solution strengthening** by bismuth



- The complications that can be caused by the presence of a bismuth phase in the microstructure are avoided by setting the level of the addition below the limit of solid solubility of bismuth in tin over typical range of temperatures to which solder joints are exposed in electronic circuitry.
    - Avoids the instability in microstructure and properties caused by bismuth in excess of the solid solubility limit going in and out of solution over the operating temperature cycle of the electronic assembly
    - Avoids the electromigration that occurs when there are particles of bismuth in the microstructure rather than just in solid solution in the tin

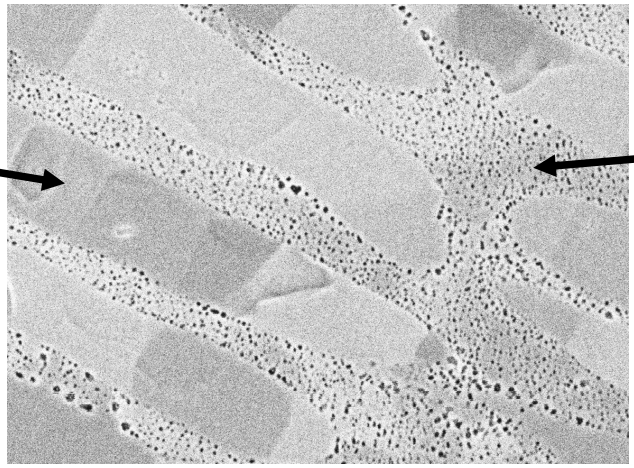




<u>Totally different</u> strengthening mechanism!

The strength and reliability of “SAC305” is dependent on the ability of the particles of the intermetallic compound Ag_3Sn, which are formed the during solidification of the solder, to block the movement of the crystal defects (“dislocations”) that make it possible for the otherwise very strong crystals of tin to deform at a relatively low stress.

Intermetallic particles formed in SAC305 during solidification of the eutectic phase SAC305 in the spaces between the primary tin dendrite arms.



Both alloying additions in SAC305 react completely with tin to form intermetallic compounds, Ag_3Sn and Cu_6Sn_5; the matrix in which they are dispersed is pure tin, free of any strengthening mechanism.

Particles are effective in blocking dislocation movement only when they are closely spaced. In the fresh, as-solidified solder, the Cu_6Sn_5 particles are few and widely spaced and make only a small contribution to the strength of the as-soldered SAC305. In the as-soldered SAC305 the Ag_3Sn particles are closely spaced and thus effective strengtheners.

However small particles, with a very high surface area to volume ratio are thermodynamically unstable and even at ambient temperature grow by the mechanism known as “Ostwald Ripening”. The silver in the smaller particles migrates to larger particles. As the smaller particles disappear the spacing between the particles increases to the point where they are no longer effective obstacles to dislocation movement and the strength of the solder falls towards that of pure tin.

The strength and reliability of SN100CV comes from the bismuth in solid solution is the tin phase that makes up the bulk of the volume of the solder joint.

Strengthening without failure-accelerating side effects!

Particle Strengthening

The pile-ups of dislocation that occur behind the particles of particle-strengthened solder alloys drive the recrystallization that is the beginning of the failure mechanism in SAC305. The dislocations climb out of the pile-up to form low angle boundaries that eventually turn into high angle boundaries. The sliding of the grains along those high angle boundaries creates the cracks that eventually connect and result in a loss of electrical continuity, i.e. joint failure.

Solid Solution Strengthening

The distortion of the crystal lattice of the tin caused by the larger bismuth atoms embedded in the lattice slows the movement of dislocations, providing resistance to deformation without the generation of the dislocation pile-ups that drive the recrystallization that begins the failure process.

The SN100CV Reliability Package

A combination of properties that deliver a unique package of cost-effectiveness and reliability

Why DKL Metals is Bringing SN100CV to the UK Now

As Nihon Superior's long-standing partner, **DKL Metals** has identified SN100CV as the critical link for UK firms looking to de-risk their production.

- **Cost Stability:** By removing silver entirely, DKL Metals helps manufacturers escape the volatility of precious metal markets.
- **Seamless Integration:** SN100CV is a true drop-in replacement. It can be reflowed using the same thermal profiles as SAC305, meaning no costly process re-validation is required.
- **Superior IMC Layer:** The Ni-stabilised hexagonal form of the intermetallic compound ensures a thin, smooth, and slow-growing IMC layer that resists cracking.

Supporting the UK Market

At DKL Metals, our goal is to provide the UK market with the most advanced materials available. With SN100CV, we aren't just offering a cheaper alternative to SAC305; we are offering a more reliable one. We are ready to support local assemblers with the technical field support needed to make the switch. The SN100CV reliability package is more than just a solder; it is a combination of cost-effectiveness and world-class engineering, now available directly through DKL Metals.