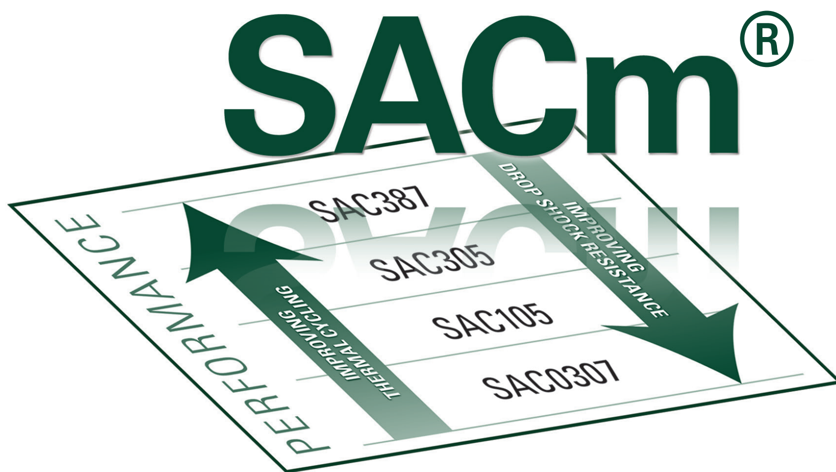
SACm®

Premier Low Ag Alloy for PCB Assembly

- **Easily substituted into existing Pb-free processes**
- **Comparable reliability to SAC305 and SnPb eutectic**
  - Superior drop shock resistance
  - Maintains thermal cycling reliability with Mn



From One Engineer To Another®

SACm® Solder Alloy

Current Industry Dilemma:

Conventional SAC alloys exist with an inherent trade-off between thermal cycling reliability (TCR) and drop shock resistance (DSR). High Ag versions do not live up to the expectations of SnPb DSR, whereas low Ag versions offer improved DSR, but lose TCR.

The Solution:

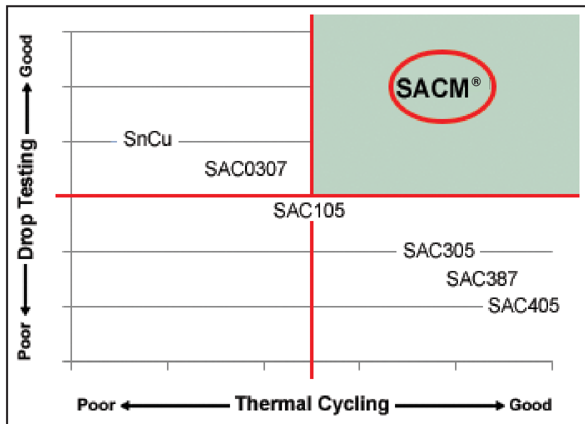
With the addition of Mn, SACm® does not compromise on reliability. The combination of low Ag, for lower material costs and improved TCR over other low Ag alloys, integrates easily into existing Pb-free processes.

The Details:

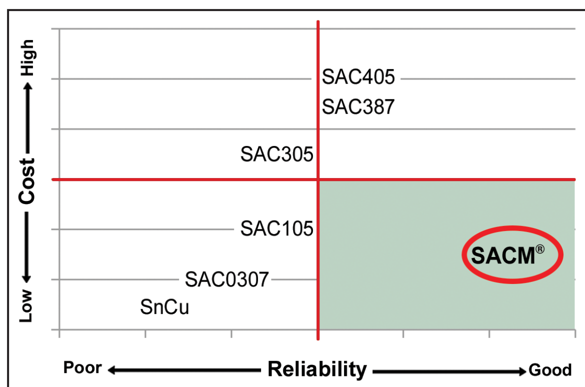
SACm® is comprised of 97.5-98.5% Sn, 0.5-1.0% Ag, and 0.5-1.0% Cu, with dopant levels of Mn. This alloy is available in solder spheres as well as powder (T3, T4, and T4.5) and solder paste.

The following results were published in papers (Dr. Lee et al.) featured on the back page.

Drop Testing vs. Thermal Cycling



Cost vs. Reliability



SACm® Basic Material Properties

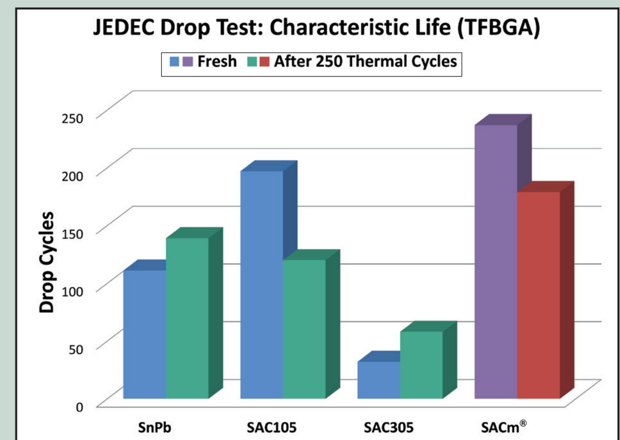
	SACm®	SAC105	SAC305
Melting Point Solidus °C Liquidus °C	217 226	217 225	217 220
Tensile Strength (PSI)	5625	5640	7200
Yield Strength (PSI)	3590	3359	5289
Young's Modulus (KSI)	2110	2150	2410
Elongation (%)	15.7	13.4	19.3

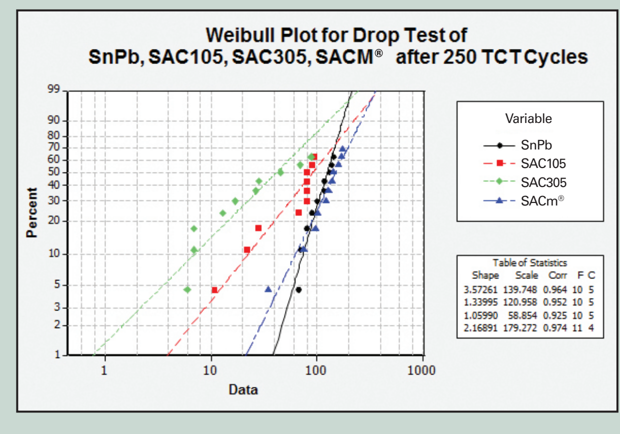
JEDEC Drop Test Performance

Typically, improved drop shock resistance is achieved with low Ag content SAC solder alloys. However, SAC105 (or even SAC0307) still does not equal the DSR of SnPb eutectic alloys. SACm® delivers significantly improved DSR, rivaling SnPb drop shock performance.

Testing Conditions:

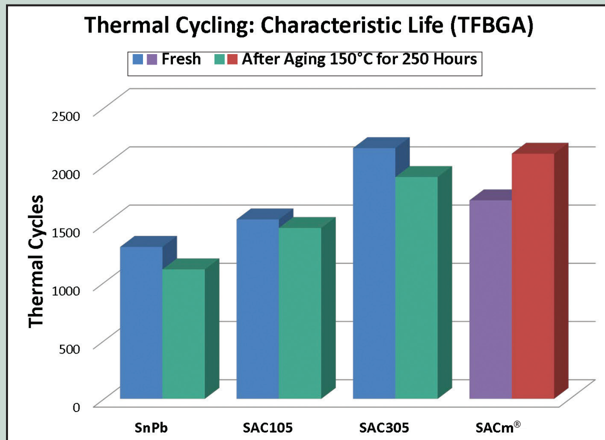
- Components – 0.5mm pitch BGA
- PCB – 8 layer FR4 with OSP finish
- Test Conditions – JESD22-B111
- Preconditioning – 250 cycles of thermal cycling





Thermal Cycling

Low Ag content will also have the trade-off of compromised thermal cycling reliability. SACm™ boosts TCR, greatly outperforming SAC105, and is comparable to SAC305.

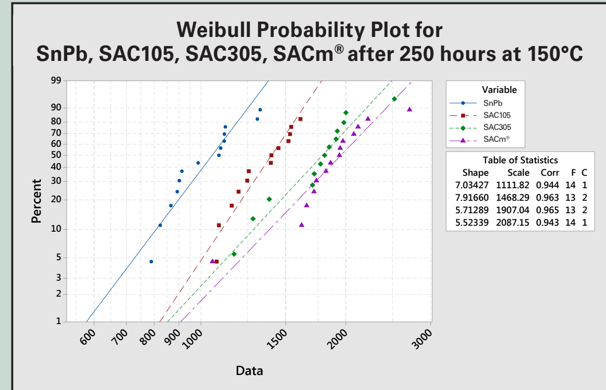


Testing Conditions:

- Components – 0.5mm pitch BGA
- PCB – 8 layer FR4 with OSP finish
- -40°C to +125°C; 42 min/cycle; 10 minute dwells

Preconditioning:

- Bake at 150°C for 250 hours

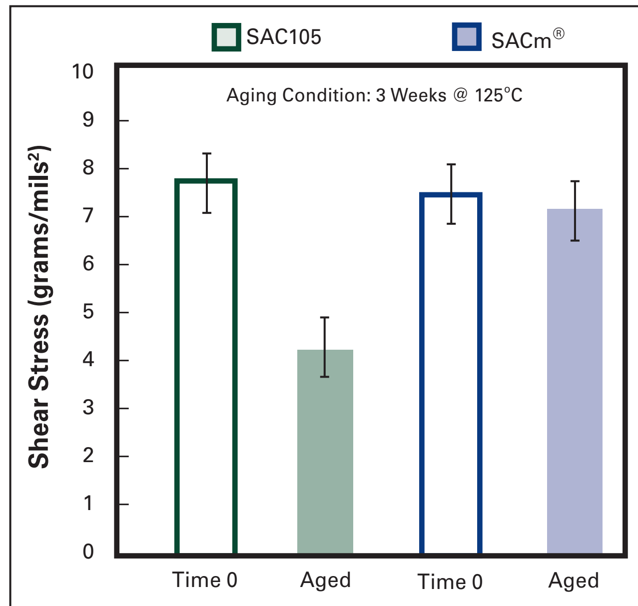


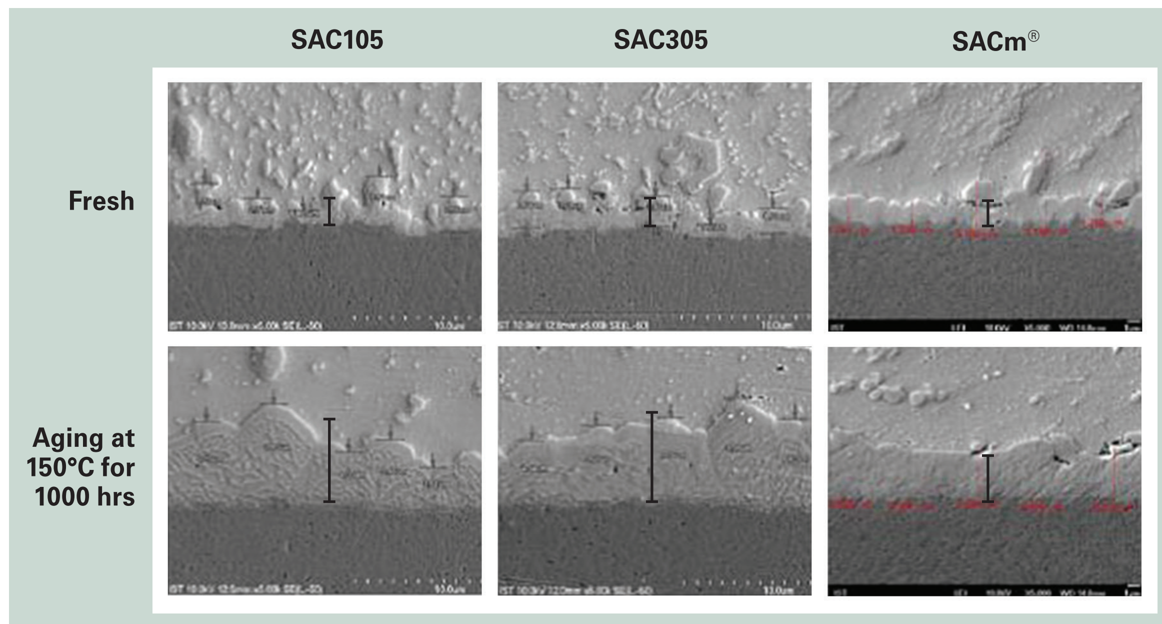
How SACm® Works

The addition of Mn helps improve reliability in two ways: it refines and limits the IMC formed, and, over time, impedes intermetallics growth and grain coarsening. A thin IMC layer shows improved DSR and TCR, whereas Mn further improves TCR by minimizing IMC layer growth.

SACm® shows an insignificant decline in shear testing after aging due to Mn maintaining the IMC layer thickness (see graph on right).

Cross sections (below) show the IMC layer before and after 1000 hours of aging. It is evident that the amount of intermetallic growth is drastically reduced, mirroring the improved reliability results.





SACm® Solder Paste

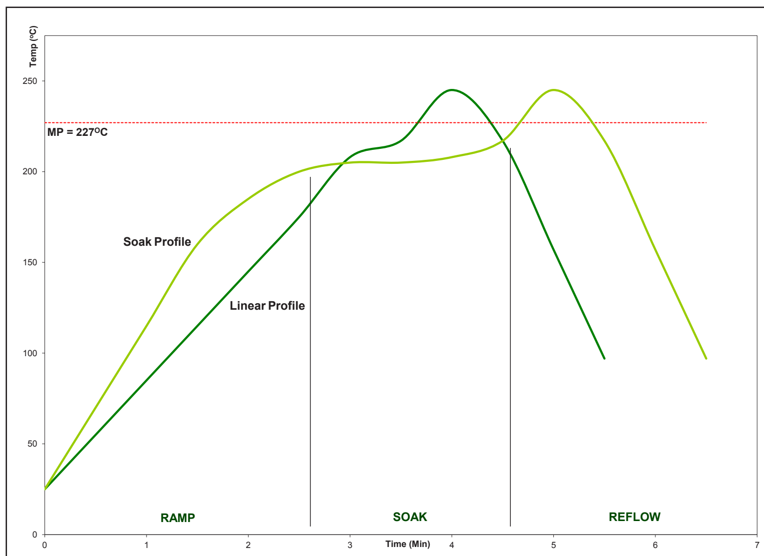
SACm® solder powder is available in IPC standard T3, T4, and Indium's T4.5 for optimal miniaturized printing applications. Indium Corporation provides top quality solder pastes for PCB assembly. To meet individual assembly needs, several fluxes from the Pb-free series of fluxes are offered with SACm®.

Shared features:

- **First-class printing performance**
  - Consistent print transfer through apertures with area ratios ≤0.66
  - Long stencil life and forgiving response-to-pause
  - High component retention tack prevents components from shifting
- **Robust reflow performance**
  - Unique oxidation barrier technology to eliminate defects during reflow
  - Wide process window for flexible reflow profiling
  - Good wetting performance on various surface finishes

Paste Name (Flux)	Halogen-Free?	Powder Size	Stencil Printing Metal Load	Features
Indium8.9	No	T3	88.50%	Eliminates HIP
		T4	88.25%	
Indium10.1	No	T3	88.75%	Lowest voiding
		T4	88.50%	
Indium8.9HF	Yes	T3	89%	HF versatile performance
		T4	88.50%	
RMA-155	Yes	T3	89%	RMA for modern challenges
		T4	88.50%	

Typical SACm® Reflow Profile



For details, technical, and reliability information, visit www.indium.com/SACm

The tech papers, *Achieving High Reliability Low-Cost Lead-Free SAC Solder Joints via Mn Doping* and *The Second Generation Shock Resistant and Thermally-Reliable Low Ag SAC Solder with Mn,* are also available for download.

Form No. 98851 (A4) R2

ISO 9001 REGISTERED

www.indium.com/SACm sacm@indium.com

ASIA: Singapore, Cheongju, Malaysia: +65 6268 8678
CHINA: Suzhou, Shenzhen: +86 (0)512 628 34900
EUROPE: Milton Keynes, Torino: +44 (0) 1908 580400
USA: Utica, Clinton, Chicago, Rome: +1 315 853 4900

©2016 Indium Corporation