SIKAMA INTERNATIONAL

RELIABLE. REPEATABLE. RESPONSIBLE. REFLOW.

FLUXLESS REFLOW WITH “EA” TECHNOLOGY

PRESENTED BY
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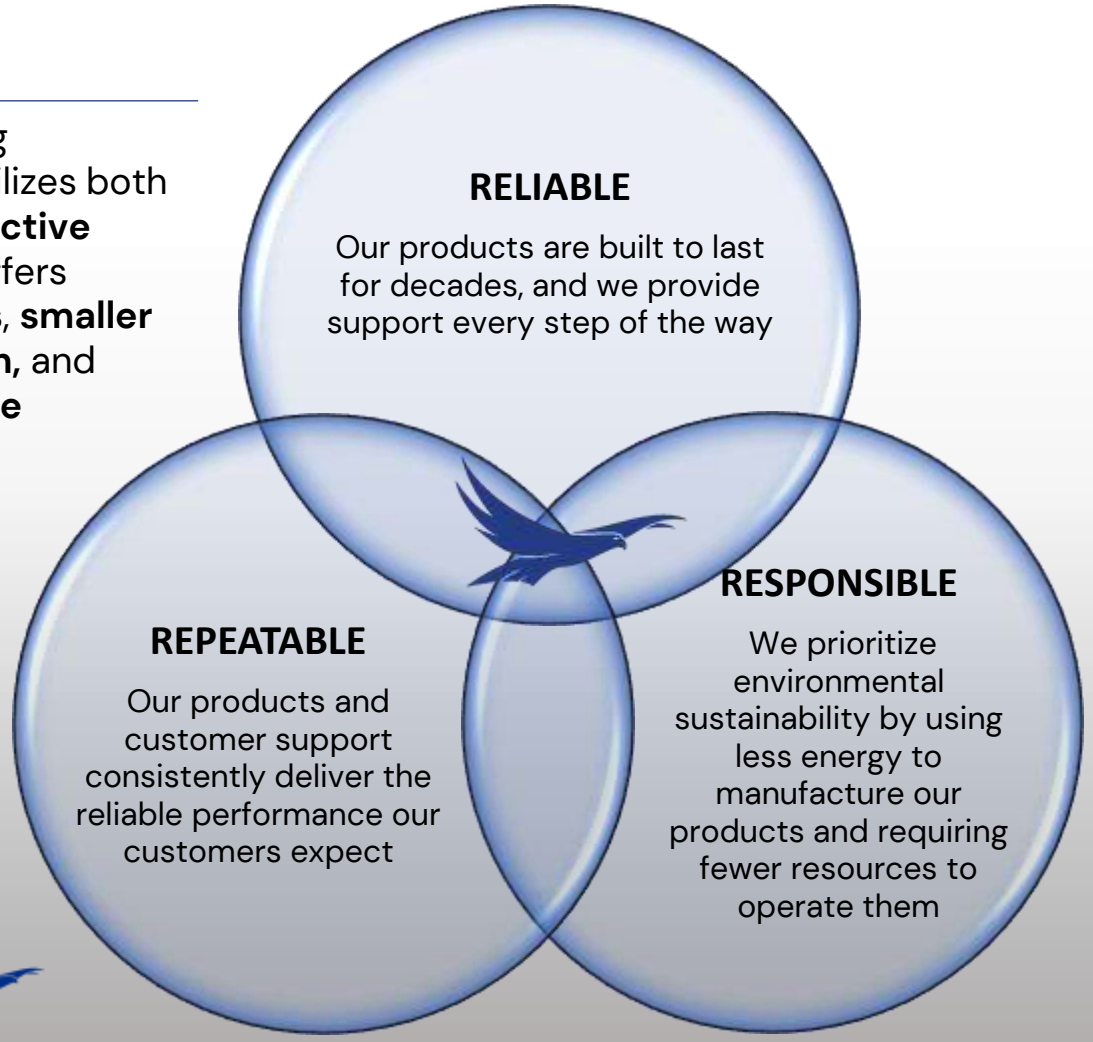
Who is Sikama

Sikama International is a leader in solder reflow solutions technology, providing top-tier quality, performance, and support

Founded:	1982
Headquarters:	Santa Barbara, CA
Support Center:	Camarillo, CA

OUR VALUE

Our proprietary heating methodology, which utilizes both **conductive** and **convective heating techniques**, offers customers **lower costs**, **smaller footprint**, **low vibration,** and **enhanced temperature precision**.



Our Products

Sikama has provided high quality reflow solutions for 42 years and continues to advance as an industry leader supporting a global customer base

FALCON SERIES

FLUXLESS

Sikama's EA1200, is the next generation of fluxless soldering. Providing safe, acid-free, high throughput fluxless soldering performance, the EA1200 sets the new high bar by using patented Electron Attachment technology.

UP SERIES

HOTPLATE

WASHERS & COATERS

Novel Flux-Free Technology with Activated Hydrogen

Electron Attachment "EA" Technology ensures efficient oxide removal ***below liquidous solder temperatures****,* ***without acids****, at* ***ambient pressure****, and with* ***high throughput****.*

Pioneered by Air Products and offered exclusively in Sikama Reflow Ovens

DRY

- Completely acid and chemical free
- Uses only N2/H2 forming gas and electricity to operate
- 100% residue free process

ATMOSPHERIC

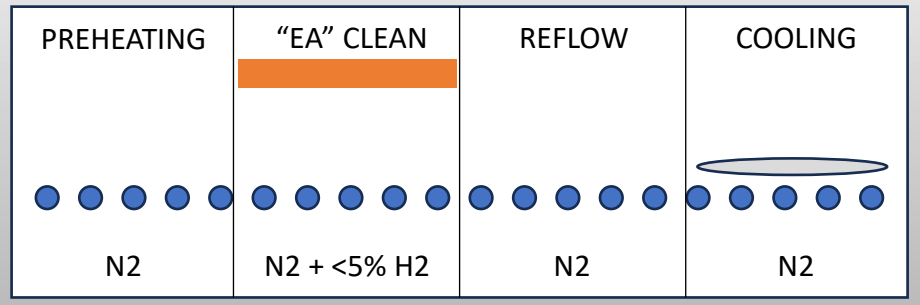
- Operates at atmospheric pressure at standard reflow processing temperatures
- O2 levels under 5ppm

NO ADDITIONAL PROCESSING STEPS

- Oxide removal occurs just before reflow
- Proven success with wafers and flip chip applications

HIGH THROUGHPUT

- Capable of up to 60 wafers per hour

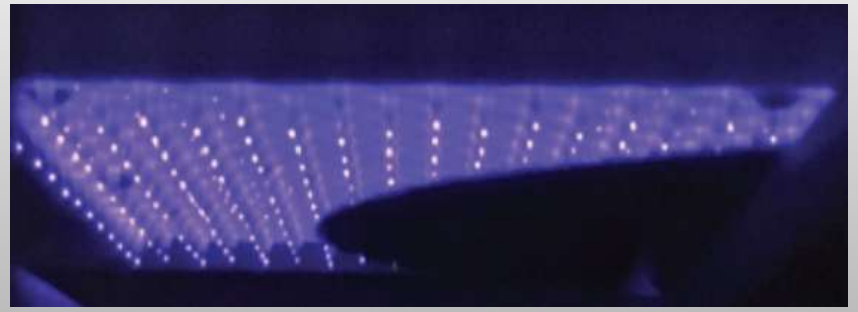


How It Works

Electron Attachment "EA" Technology uses activated hydrogen, a strong reducing agent and effective electron donor, to react with and remove oxides from substrates

THE CHEMISTRY BEHIND THE "EA" PROCESS

Dissociative Attachment	$H_2 + e^- \rightarrow H_2^- \rightarrow H^- + H$	Electrons collide with H_2 molecules, forming an unstable high-energy form of the molecule (H_2^-)
		The excited molecule quickly breaks apart resulting in a hydrogen atom (H) and a negatively charged hydrogen ion (H^-)
Direct Attachment	$H + e^- \rightarrow H^-$	Electrons collide with the hydrogen atom, forming an excited hydrogen ion (H^-)
Oxide Removal	$2H^- + SnO \rightarrow Sn + H_2O + 2e^-$	Hydrogen anions ($2H^-$) collide with the substrate surfaces resulting in highly effective oxide removal, resulting in tin metal, water vapor, and free electrons as byproducts



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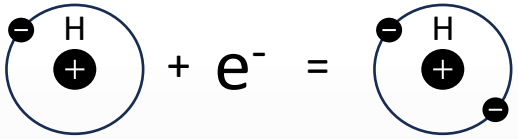
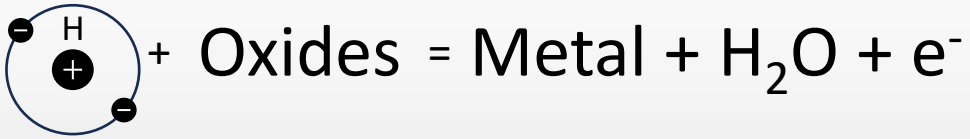
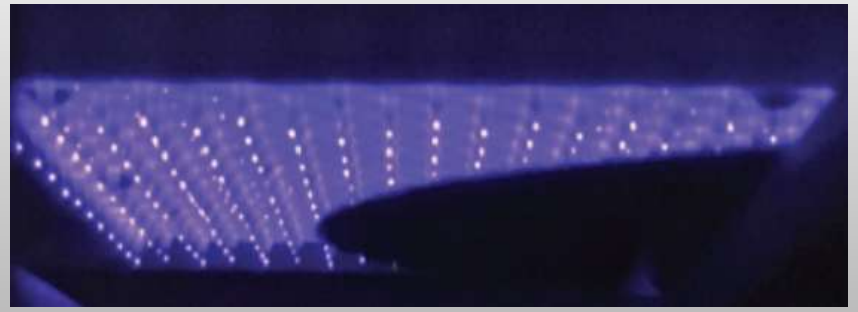
...IN OTHER WORDS

Hydrogen atoms combine with electrons to form negative hydrogen ions	
These ions react with the oxides, leaving behind metal, water, and electrons	

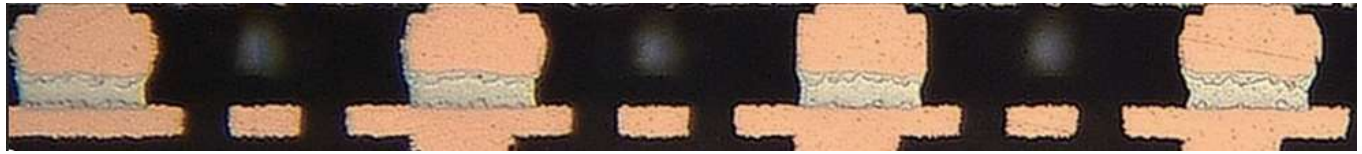


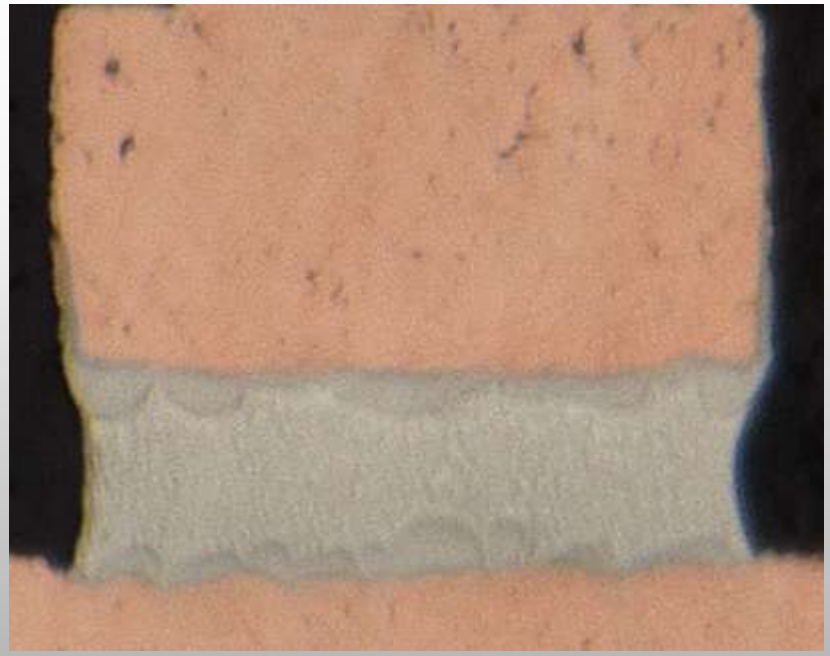
“EA” vs. Formic Acid: A Clear Advantage

Sikama’s Electron Attachment process is more capable, safer, and more versatile than formic acid

PERFORMANCE

- Capable of oxide elimination for assembled flip chip components, **an industry first**
- Completely residue free
- No tool cleaning required
- Hydrogen monolayer for extended protection
- Fully SECS/GEM and SMEMA compliant
- Continuous process flow vs batch





SAFETY

- CE Certified, SEMI S2, S8, F47, and NFPA79 compliant
- Uses non-flammable N2/H2 forming gas with <5% H_2
- No corrosive chemicals

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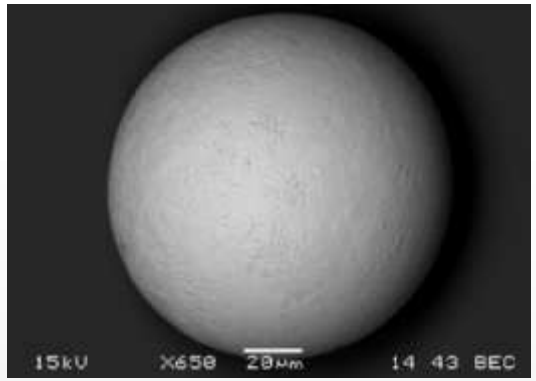
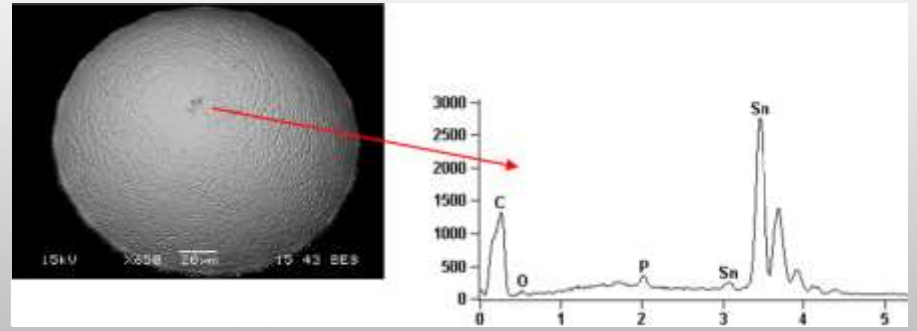


C4 Bump after “EA” Reflow



Copper Pillar after Formic Acid Reflow

“EA” vs. Formic Acid: A Clear Advantage

Sikama’s Electron Attachment process is more capable, safer, and more versatile than formic acid

LOWER COST OF OWNERSHIP

- 40% decrease in per wafer cost on average
- Maximized tool up-time
- Rapid tool start-up
- Small footprint

SIGNIFICANT ENVIRONMENTAL BENEFITS

- No toxic consumables such as formic acid
- Low energy consumption
- Safe byproducts – only water vapor, N2, forming gas

Enabling Applications

"EA" also leads to Enabling Applications.
Each process has been validated through extensive testing.

VOID TESTING

- Equal or better void test results compared to flux-based processes

ELECTRICAL TESTING

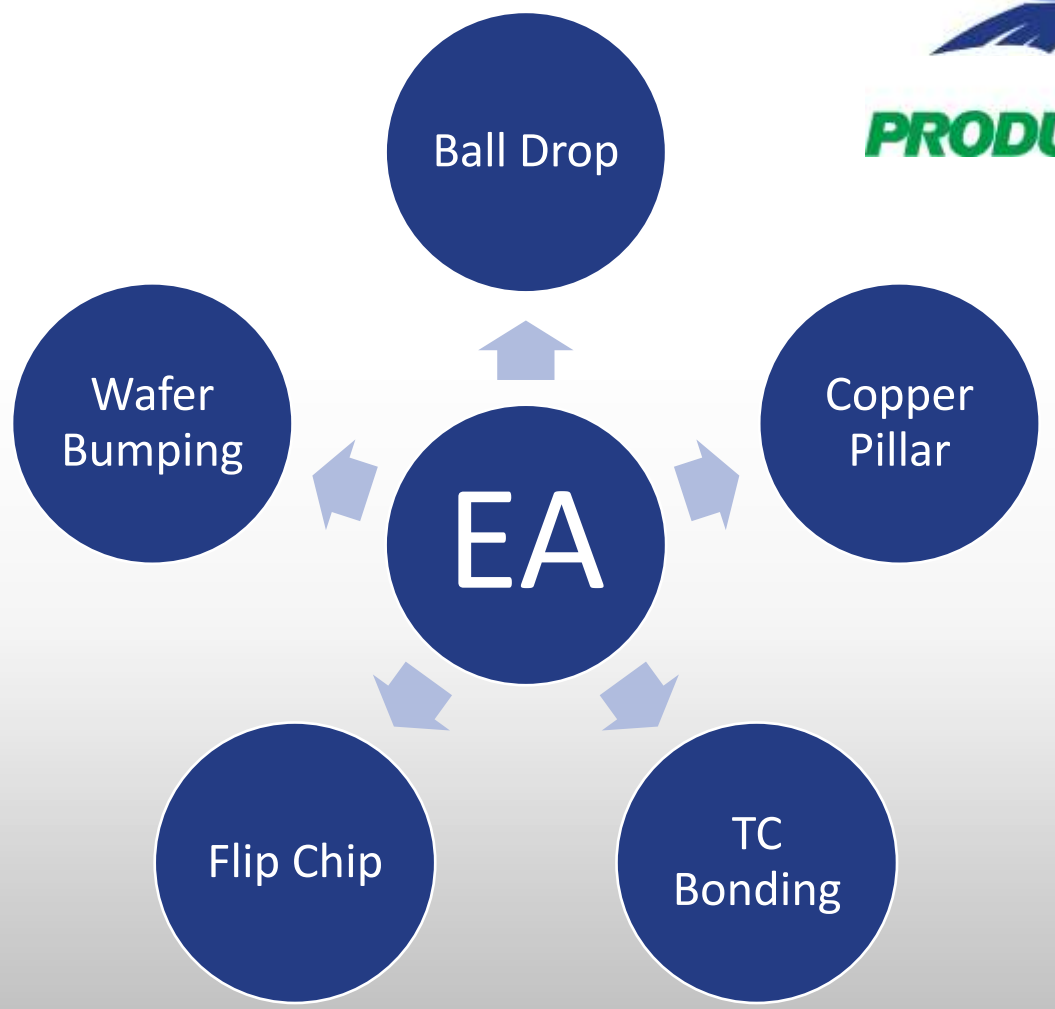
- Transistor Level SRAM testing showed negligible electrical effects

SHEAR TESTING

- Shear testing data shows highly acceptable bond strength

RESIDUAL PROTECTION

- Hydrogen monolayer provides several hours of oxide protection



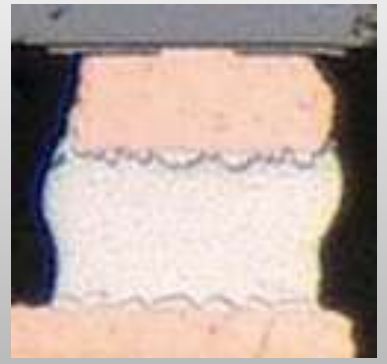
Enabling Flip Chip Applications

*"EA" fluxless reflow is the **only** fluxless process that performs effectively on Flip Chip applications*

OUR TECHNOLOGY SUCCESSFULLY REMOVES OXIDES FROM FLIP CHIP ASSEMBLIES

- Oxides from die attached flip chips can be effectively removed, resulting in successful soldering performance
- Numerous customer trials have shown success across a wide variety of substrate types
- Indium NC-702 tacky holding material can be used as an adhesive solution for die attach or ball drop

Example Sample Set 10x10mm Die; Epoxy core with ABF build up. SAC alloy pad metallization. 8000 I/O	
Cu Pillar Height	30um
Solder Cap Height	15um
Diameter	60um
Pitch	120um
Substrate Pad	70um



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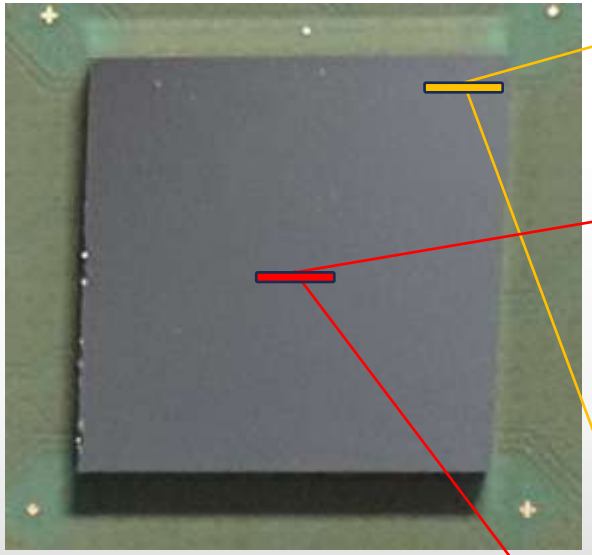
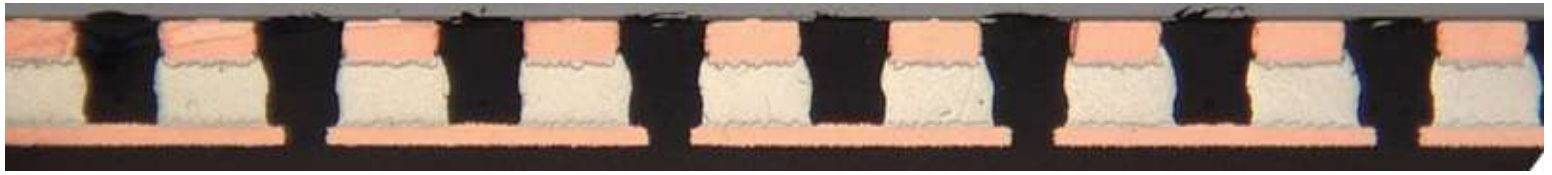
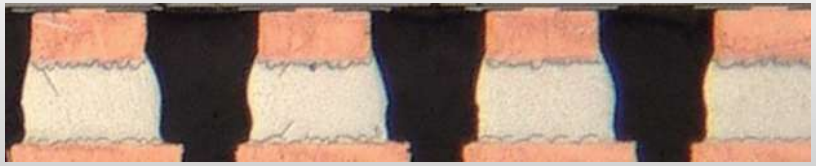


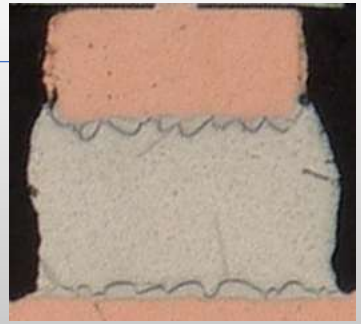
Approximate cross-section locations as indicated

Pre-cleaned using EA



Single-pass – EA plus reflow



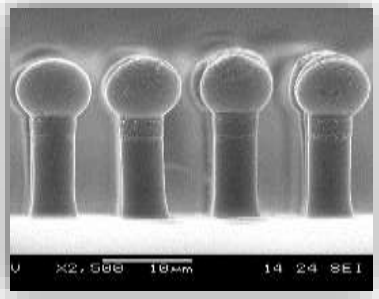


Enabling Fine Pitch Applications

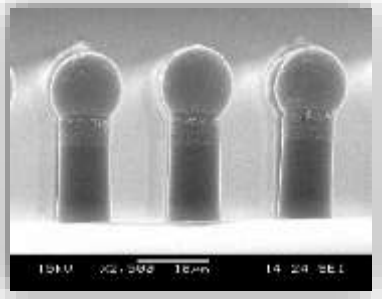
"EA" eliminates the challenge of processing small geometry substrates

"EA" TECHNOLOGY HAS BEEN PROVEN SUCCESSFUL BELOW **10-MICRON GEOMETRIES**

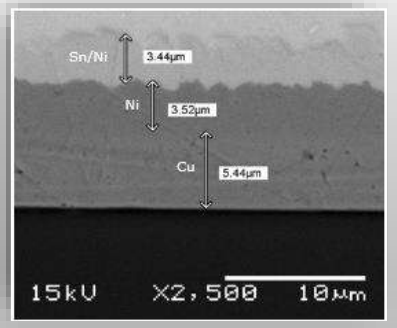
- Electron Attachment cleaning enables fine-pitch applications with both copper pillar and solder bumps



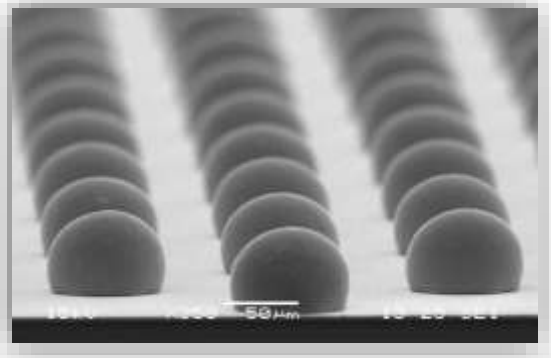
10um Pitch Copper Pillar
6um Diameter Solder Cap

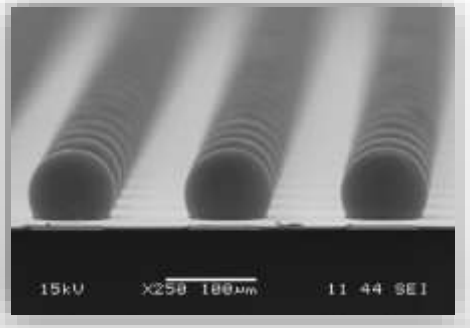


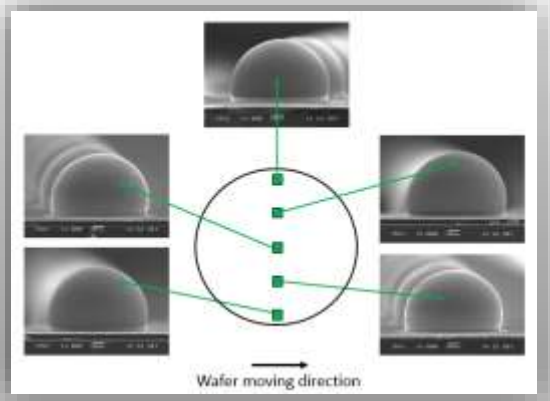
15um Pitch Copper Pillar
9um Diameter Solder Cap

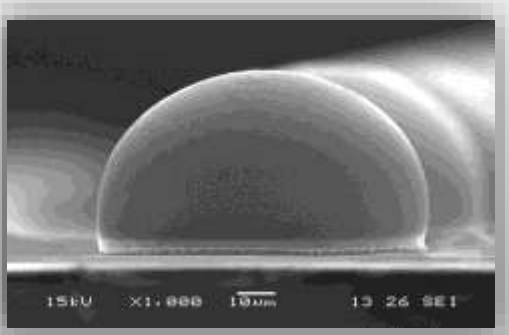


Positive IMC thickness is observed









Let us enable your next application!

Experience Our Cutting-Edge Technology Firsthand

Explore our state-of-the-art manufacturing and demo facilities in Southern California, with new locations coming soon.

DESIGN AND MANUFACTURING

Located: Santa Barbara, CA

Our Team is committed to **meticulously handcrafting each product** with the utmost **care**, **attention**, and **detail**.
Our innovative approach ensures that you, the customer, are actively involved each step of the way, **guaranteeing the highest quality and performance**.

CUSTOMER EXPERIENCE CENTER

Located: Camarillo, CA

Our Customer Support Center offers **on-site testing, profile evaluation, and low run production** for our customers.
Our Customer Support Center is a dedicated space for our customers to receive a **personalized** and **hands-on experience** with all our products.
Other locations being evaluated for customer experience sites.

DEMONSTRATION FACILITY

Located: AirProducts Shanghai

Sikama has partnered with AirProducts to utilize their Shanghai facility which offers a **full suite of research and development capabilities** using "EA" technology.