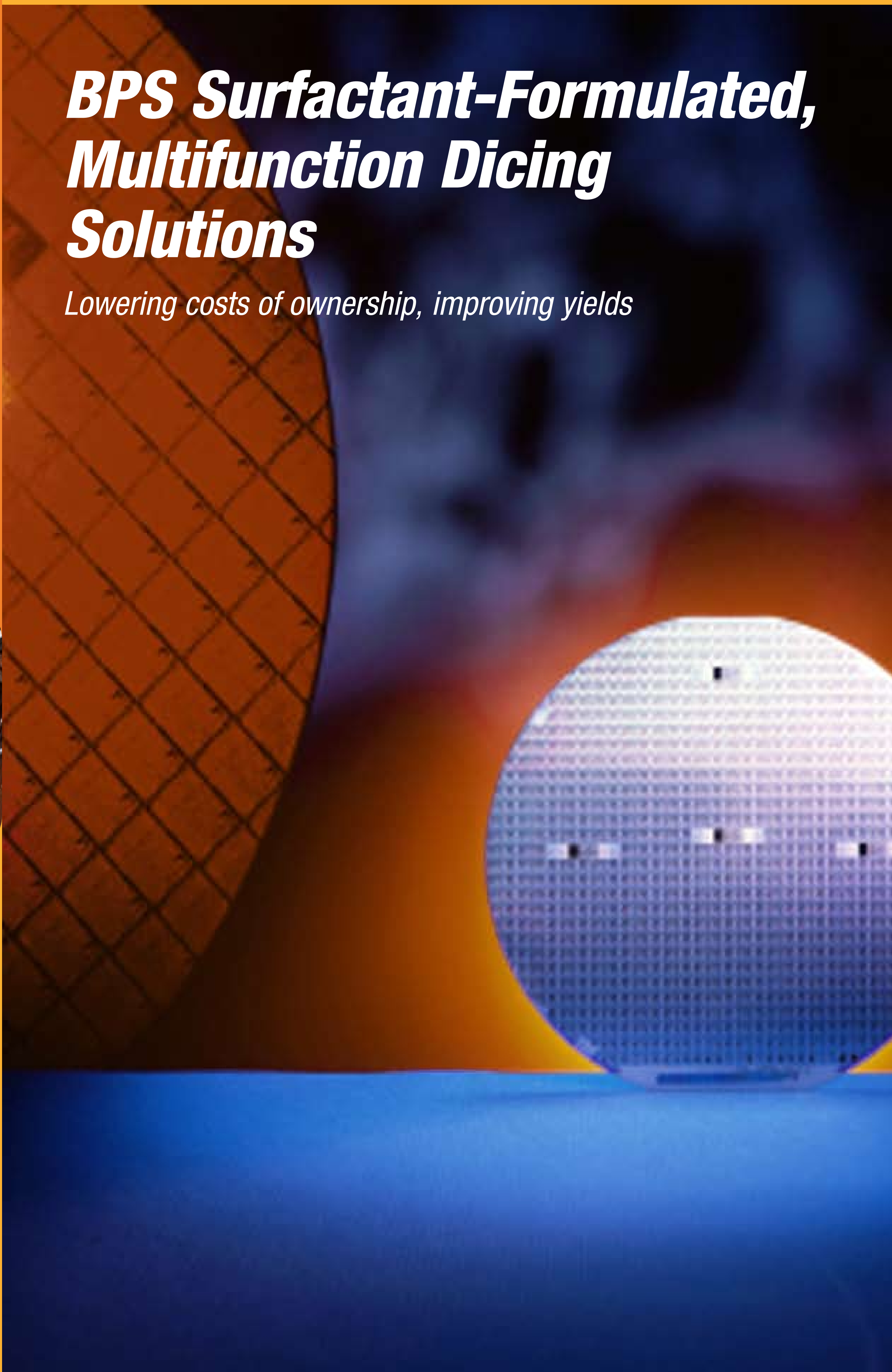
AIR PRODUCTS

BPS Surfactant-Formulated, Multifunction Dicing Solutions

Lowering costs of ownership, improving yields

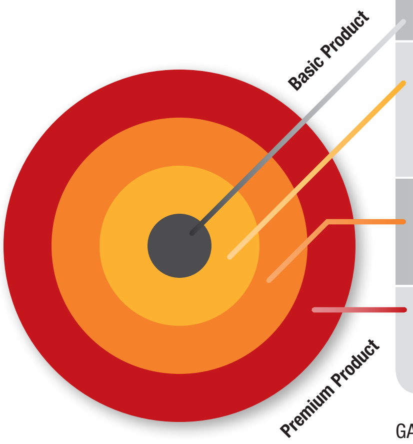


A major breakthrough for silicon, BGA, and ceramics dicing applications.

Dice with BPS!

For dicing, BPS (Better Process Solutions) chemistries effectively remove saw residues (swarf) through better wetting, while removing and mitigating the regrowth of metal oxides from bond pads and bumps.

Fig. 1: The BPS Value Proposition for Dicing



	CO_2	BPS-729	BPS-729-B	Comps
Cut Quality (Heat Dissipation)	■	■	■	■
Residue Removal	■	■	■	■
Sufactant		■	■	■
Low Foam	N/A	■	■	
High Conductivity			■	
High Product Dilution	N/A	■	■	
Does Not Support Bio-Growth		■		
Dioxin/Silicone/Mineral Oil-Free		■	■	
Long Shelf-Life	N/A	■	■	
Cu Ox Removal		■		
Cu Ox Regrowth Reduction		■		
Al Ox Removal		w/BPS-100		

GAIN IMPROVED TECHNICAL PERFORMANCE AT THE SAME COST USING AIR PRODUCTS' BPS PRODUCTS.

An Overview

Air Products' BPS (Better Process Solutions) products are aqueous solutions that are made for cleaning applications in electronics test, assembly, and packaging—specifically to improve yields at probe/test, as a dicing solution, allowing flux-less bump reflow and reducing no-sticks at wirebond—all on a variety of substrates. BPS solutions have extremely low etch rates on commonly used substrates in the industry, selectively removing metal oxides, fluorine, organic residues, and particulate contaminants.

Air Products has developed the right solutions for your wafer manufacturing needs. We have a broad portfolio of materials, the technical expertise needed to help you integrate them quickly into your processes, and the focus to provide these solutions effectively.

BPS products can be safely used on a variety of devices including PCBs, WLCSP, CSP, MEMS, and flip-chips to remove oxides from Al and Cu pads as well as Sn/Pb and Pb-free solder bumps—while causing *no damage to base metals and substrates* such as Si, GaAs, InP, and passivation layers.

Fig. 2: Clean Up Your Bond Pads

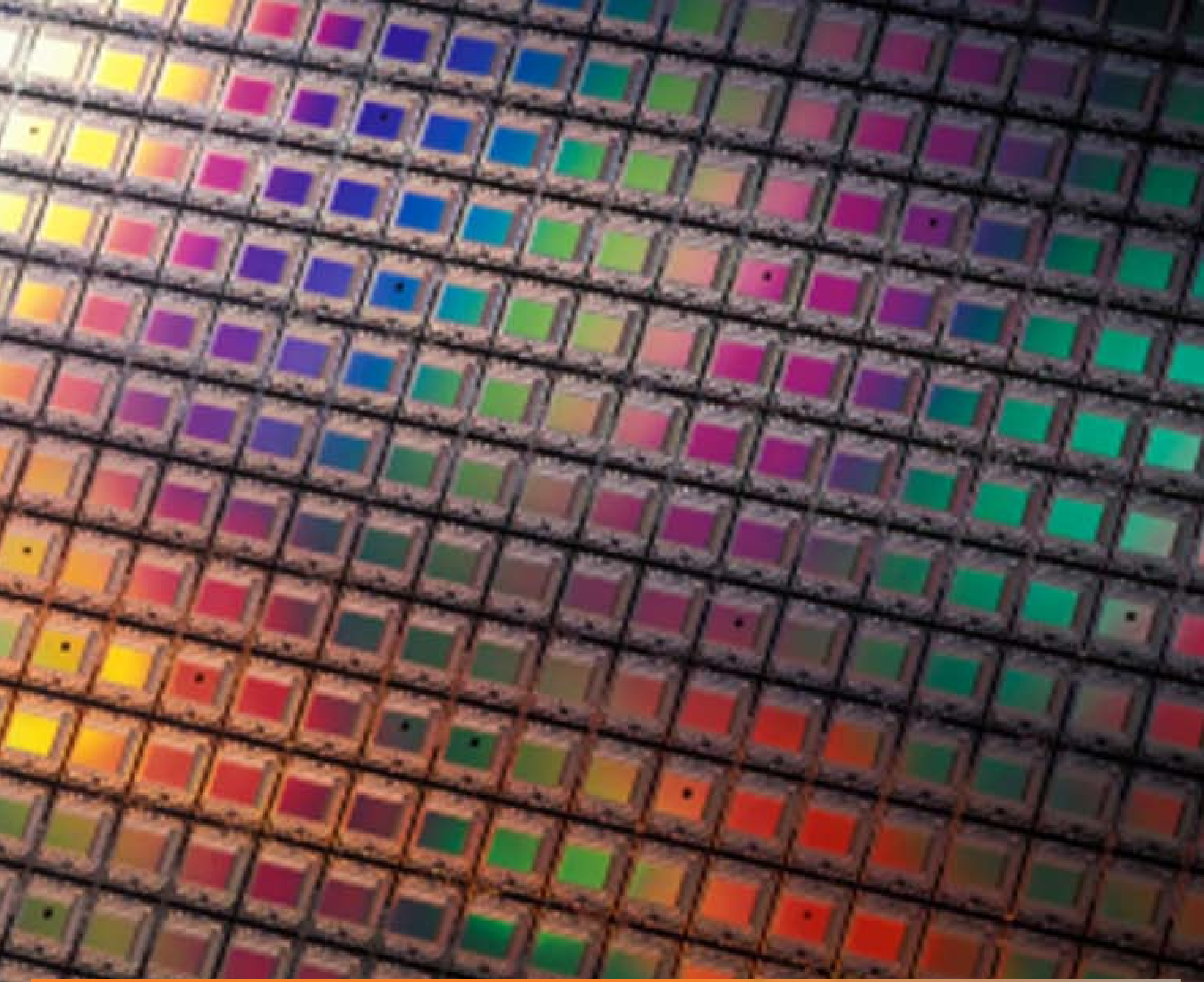
Saw using DIW. Saw using BPS-729.

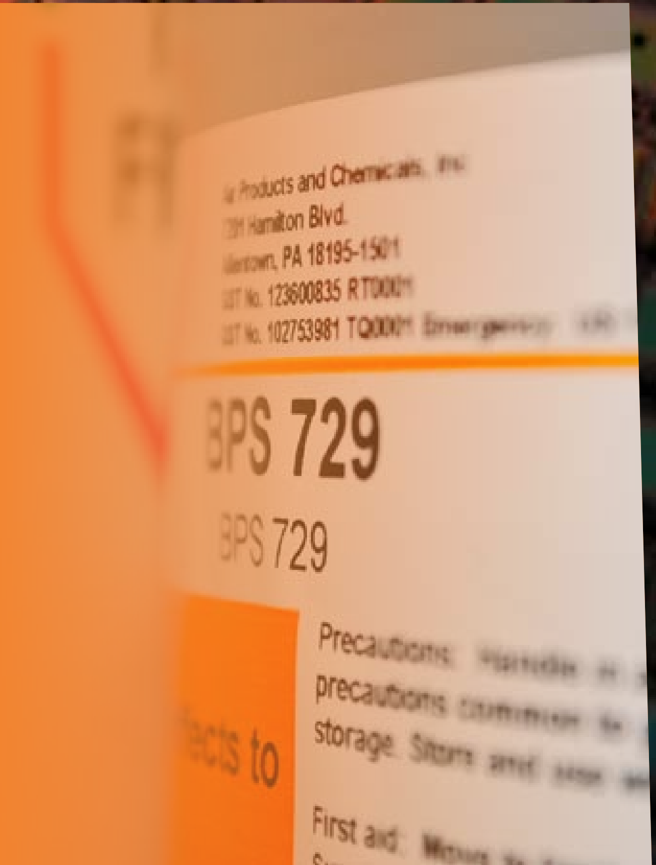
REMOVE AND PREVENT CORROSION, AND INCREASE CONDUCTIVITY OF BOND PADS.

Our Advanced Dicing Solutions

The **BPS-729 series** products are surfactant-containing aqueous solutions that are injected into the DIW stream as you dice. Featuring low-foam, high conductivity, and a two-year shelf life, BPS-729 series products can help eliminate the need for CO_2 sparging. Depending on your application, BPS-729 series products can work at dilutions as low as 1000:1 in DIW, reflecting in a lowered cost of ownership. The BPS-729 series reduces kerf, chipping, and burring on various substrates including silicon, ceramics and BGA, with proven stability in closed-loop recirculation systems. BPS products contain no PFOS, mineral oils, silicones, or dioxins, and are compatible with commonly used blades and materials of construction.

BPS-729-B is our super-low-resistivity dicing solution that is especially suitable for static-sensitive devices. Electrostatic discharge (ESD) can damage vital components on your product and also increase the accumulation of residues as you dice. BPS-729-B reduces the resistivity of your dicing solution by orders of magnitude! BPS-729-B lowers surface tension substantially even at 1000:1, allowing more cooling water to enter deep cuts, cool the blade, and effectively carry away swarf. Recommended for use at dilutions between 200:1 and 1000:1.

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BPS 729
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Precautions:
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First aid:

BPS-729 is our premium dicing solution that not only prevents adherence of silicon particles and saw residue (swarf), but also removes oxidation from bond pads or bumps and retards their regrowth. Because of a very low etch rate on various materials, base metals are not affected. BPS-729 works through a combination of surfactant action and a unique micro under-etch process that dislodges particles embedded in the surface—without affecting the underlying substrate. BPS-729 is specially engineered for ultra-low foam to prolong the life of your equipment.

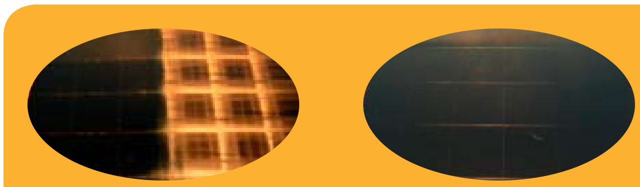
BPS-729 is recommended for use between 200:1 to 1000:1 in DIW dilutions for most cleaning applications; ~100:1 for copper oxide removal; and ~100:1 for aluminum oxide removal in combination with a pre-treatment of BPS-100.

AIR PRODUCTS HAS A BROAD PORTFOLIO OF MATERIALS TO HELP CUSTOMERS IMPROVE THEIR WAFER MANUFACTURING PROCESSES.

BPS Solutions Work

These actual comparisons underscore the effectiveness of Air Products' BPS-729 for dicing:

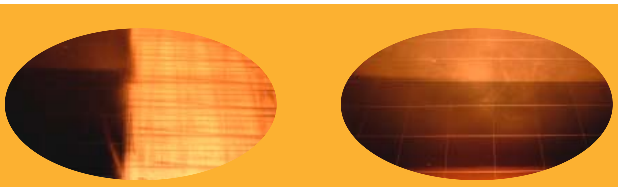
Fig. 3: Cleaning (Swarf Removal): Aluminum*



Dice using DIW
Leaves thick residue/swarf. Wafer had to be scrubbed (on left) to remove swarf.

Dice using BPS-729 @ 1000:1
Cleans wafer completely!
No need for scrubbing wafer!

Fig. 4: Cleaning (Swarf Removal): Copper*



Dice using DIW
Leaves thick residue/swarf. Wafer had to be scrubbed (on left) to remove swarf.

Dice using BPS-729 @ 1000:1
Cleans wafer completely!
No need for scrubbing wafer!

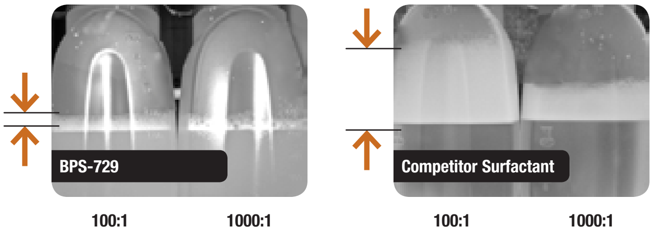
BPS SOLUTIONS EFFECTIVELY REMOVED SWARF THROUGH SUPERIOR WETTING—EVEN DOWN TO 1000:1 DILUTION—ELIMINATING ADDITIONAL RINSE PROCESSES.

Fig. 5: High Conductivity Applications

Chemistry (w/Lab-quality DIW)	DIW	DIW + CO_2	BPS-729 @ 500:1	BPS-729-B @ 500:1
Resistivity (M-Ohm)	1.8	0.02	<0.05	<0.0002

BPS-729 AND BPS-729-B REDUCE RESISTIVITY OF DIW MORE EFFECTIVELY THAN CARBON DIOXIDE CAN BY SEVERAL ORDERS OF MAGNITUDE—ALLOWING YOU TO DICE STATIC-SENSITIVE DEVICES.

Fig. 6: Foaming Performance



BPS-729 IS ENGINEERED FOR ULTRA-LOW FOAM PERFORMANCE! AT 1000:1 DILUTIONS, FOAM CREATED BY BPS-729 DISAPPEARS IN UNDER 3 MINUTES (LEFT) VERSUS 15 MINUTES FOR A COMPETITIVE SURFACTANT.

The BPS Product Family

BPS wet chemistries are an efficient and simple way of removing metal oxides, fluorine, particulate contamination, organic residues and flux from wafers without damaging the underlying metals. Customers benefit from lower costs through improved yield and lowered reruns in their test, assembly, and packaging applications.

Three distinct product groupings include photo resist and flux removers (BPS-125), oxide removers (BPS-170, BPS-172, BPS-100 and BPS-101), and dicing solutions (BPS-729 and BPS-729-B)—all designed to eliminate or minimize problems caused by residues and metal oxides. BPS solutions in cleaning applications have short processing times and a much lower cost associated with them than current techniques.

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* LoadPoint NanoAce tool; 6" SI wafer with 25mm x 25mm cut; 4 minute saw process; scrub LHS; dry spin; inspected in black box environment.

BPS Dicing Solutions: The RIght Stuff

The BPS-729 series of products for dicing...

- Remove saw residues using advanced surfactant technology to effectively reduce surface tension to prevent embedding of surface particles.
- Improve kerf and chipping performance on silicon, BGA, and ceramics.
- Lower resistivity to reduce ESD.
- Lower foam compared to conventional surfactants.
- Exhibit stable performance in closed-loop recirculation systems.
- Further lower cost-of-ownership with dilutions as low as 1000:1 in DIW.
- Prevent bond pad corrosion and mitigate oxide regrowth (BPS-729).
  - —Do not attack base metals. Typical etch rates on commonly used metals are < 1A/min.
  - —Remove copper oxides as you dice to improve downstream wire bonding processes; mitigates regrowth for up to 14 days!
  - —Remove Al oxides in combination with BPS-100.
  - —Do not attack dicing blades.
- Accommodate most existing tools without retrofits.
- Do not sustain bacteria and other bio-growth.
- Do not contain PFOS, mineral oils, silicones or dioxins
- Have a two-year shelf life and do not separate or coagulate over time.
- Are compatible with commonly used materials of constructions.

BPS SOLUTIONS SAVE YOU MORE BECAUSE THEY HAVE A TWO-YEAR SHELF LIFE, CAN BE APPLIED AT ROOM TEMPERATURE, AND DO NOT CONTAIN PFOS OR SILICONES. WE'VE PACKAGED THEM THEY WAY YOU NEED THEM—GALLON BOTTLES, FIVE-GALLON PAILS, 55-GALLON DRUMS, OR 200-GALLON TOTES.

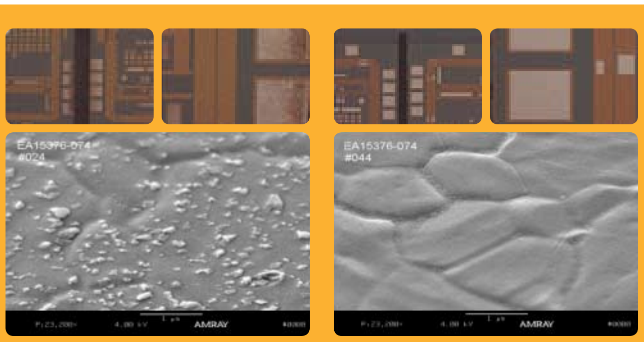
The Power of BPS in Oxide Removal

Cleaner, oxide/corrosion-free bond pads and bumps mean improved performance through lower failure rates at downstream operations such as wire bonding, flip-chip bonding, reflow and soldering!

BPS-729 is our premium product that removes metal oxides off bond pads and bumps as you dice, improving their conductivity—while causing no damage to the underlayers and vital components. Gentle on metals, tough on oxides!

BPS-729 provides additional cost of ownership benefits by removing the need for costly plasma etch processes. BPS solutions save you more because they have a two-year shelf life, can be applied at room temperature, and do not contain PFOS or silicones. We've packaged them they way you need them—gallon bottles, five-gallon pails, 55-gallon drums or 200-gallon totes.

Fig. 7: Aluminum Oxide Removal* (Bond Pads)

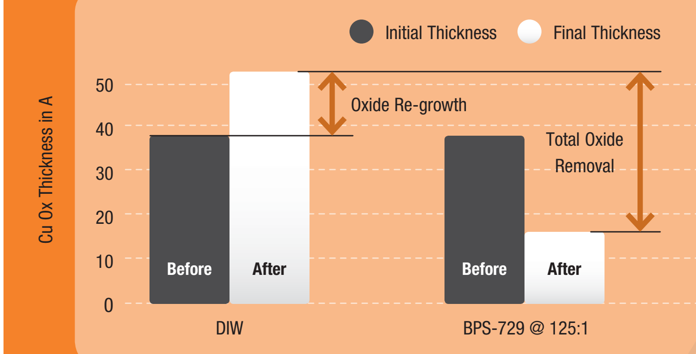


Dice using DIW.

Dice using BPS-729 after BPS-100 pre-treatment.

BPS-729 IN COMBINATION WITH A PRE-TREATMENT OF BPS-100 ALLOWS YOU TO REMOVE ALUMINUM OXIDE THAT MAKES YOUR BOND PADS LIKE NEW! NOTE THE CLARITY OF THE GRAIN BOUNDARIES AFTER TREATMENT.

Fig. 8: Copper Oxide Removal: BPS-729



BPS-729 REMOVES COPPER OXIDE EFFECTIVELY EVEN DOWN TO 100:1 DILUTION.

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* LoadPoint NanoAce tool; 6" SI wafer with 25mm x 25mm cut; 4-min. sawing; scrub LHS; dry spin; black box inspect.

Our Emphasis on Safety

We are an electronics materials supplier customers know and trust. We work to fully understand our customers' needs and to help them find the best materials solutions. But, most importantly, the people on our Electronics Division team are passionate about what they do. They are determined to help every customer squeeze the most out of every molecule, and to deliver those molecules 24/7 to where they're needed, when they're needed.

A History of Proven Performance & Commitment to Our Customers

This brochure provides only a brief overview of our broad range of capabilities for improving testing, packaging, and assembly applications. We are involved in all aspects of wafer cleaning. We have nearly four decades of electronics industry experience and local expertise. We will help you develop the smaller, faster and more powerful electronics the world demands. Visit us at www.airproducts.com/bps or contact:

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