

S-Bond™ an innovative bonding technology





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The unique metallic bonding elements in S-Bond™ truly an advance in metal, ceramic, composite and glass joining technology. These innovative active alloys wet and join most materials, including metals, glass, ceramics and composites, in air without the use of chemical fluxes. Plus, since S-Bond™ is specially designed for use at low soldering temperatures between 240°C and 480°C, it becomes an extremely cost-effective solution for even your toughest bonding challenges. At these temperatures, heating can be achieved through low-cost induction, hot-plate or flame, which helps to automate the bonding process and results in significant cost savings for your organization. Another value of S-Bond comes from the fact that the alloys are active with low capillarity, which means the product stays where it is placed and does not run like typical solders. In fact, S-Bond does not wet or bond until it is mechanically activated.



simple,
strong and secure

S-Bond™ a Versatile Bonding Technology

for joining...

- Light metal alloys (Al, Mg, Ti, Be)
- Conventional alloys (Cu, stainless steel, nickel)
- Foamed materials (Cu, Al, and Graphite)
- Sintered materials
- Aluminum metal matrix composites (Al-MMC's)
- Silicon
- Ceramics(oxides and nitrides) Magnetic and piezo-electric materials



Joint Materials	S-Bond™ Alloy 220 R.T. Lap Shear Strength
Al-Al	70 - 100 MPa
Al:Cu	45 - 55 MPa
Al-St. Steel	30 - 45 MPa
St. Steel:St. Steel	40 - 50 MPa
Glass:Brass	20 - 30 MPa
Al ₂ O ₃ :Al	15 - 25 MPa
AlSiC:AlSiC	35 - 55 MPa
AlSiC:St. Steel	20 - 40 MPa

These strengths indicate that excellent levels of bond can be achieved between many materials using S-Bond™ materials and process





and process technology. The joints are capable of hermetic sealing, high vacuum integrity, excellent strength to high homologous temperatures (80% of melting temperature).

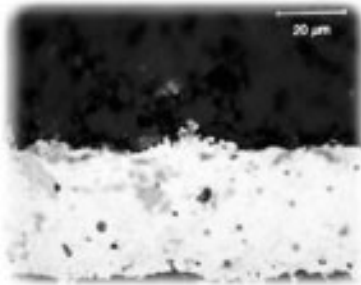
A Winning Combination

S-Bond™ Alloys are currently available in two alloys for bonding at 250° and 450°C. S-Bond™ alloys have been derived from other solders and are alloyed with a unique and patented combination of Tin (S-Bond™ Alloy 220) and Zinc (S-Bond™ Alloy 420) with silver, titanium, gallium and other rare earth elements. This blend results in S-Bond's™ ability to function as a

S-Bond™ materials and properties

"universal" joining agent, appropriate for bonding metals, glass, ceramics and composites with metal and ceramic phases.

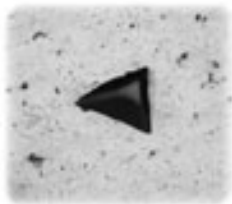
S-Bond™ 220 has been demonstrated to joint a wide range of light metals, composites, ceramics, silicon and glass. Examples of the structures of such joints are shown here.



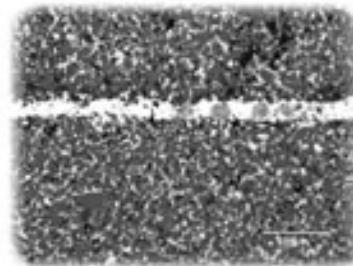
AlN bond



Cu bonded to Al₂O₃



Diamond bonded to S-Bond™



Al-MMC (Al:SiC) bonded to itself

S-Bond™ Alloy 220

S-Bond™ Alloy 420

Composition Range	
■ Sn-Ag based alloy with Ti (~4w/o) and rare earth elements	
Melting Range	
■ Solidus Temperature:	221°C (428 °F)
■ Liquidus Temperature:	232°C (447 °F)
■ Joining Temperature:	250 - 280°C (482 - 536 °F)
Physical Properties	
■ Density:	7.4 g/cc (0.264 lbs / in ³)
■ Thermal Coeff. of Expansion:	~ 19 x 10 ⁻⁶ / °K
■ Electrical Resistivity:	1.67 x 10 ⁻⁷ ohm meters (similar Pb-Sn solders)
■ Thermal Conductivity:	
■ Intrinsic:	48 W/mK
■ In Al:Cu Joints:	220 W/mK

Composition Range	
■ Zn-Ag based alloy with Ti (~4 w/o) and rare earth elements	
Melting Range	
■ Solidus Temperature:	415°C (780 °F)
■ Liquidus Temperature:	420°C (790 °F)
■ Joining Temperature:	430 - 450°C (805 - 840 °F)
Physical Properties	
■ Density:	7.1 g/cc (0.250 lbs / in ³)
■ Electrical Resistivity :	1.5 x 10 ⁻⁷ ohm meters
■ Thermal Conductivity:	26 x 10 ³ /K



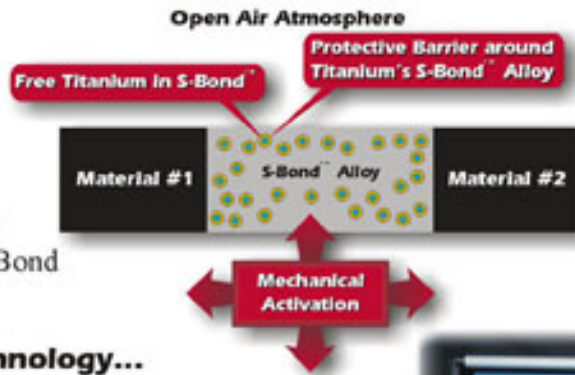


S-Bond™ process & production technology

The S-Bond™ Process

Thanks to the cutting-edge technology behind S-Bond™, achieving strong and long-lasting bonds has never been simpler. In practice, effective application of S-Bond™ requires a few simple steps:

- Clean surfaces.
- Preplace alloy.
- Heat surfaces to melt alloy.
- Mechanically activates S-Bond™ alloy via agitation
- Press joints together until S-Bond alloy is solidified.



Mechanical activation in laboratory practice

S-Bond™ ... Production Technology...

A variety of equipment is available to make the S-Bond™ process even easier including the Mini S-Bonder™, the S-Bonder™ Ultrasonic Press and the S-Bonder™ Roto-Oscillating Press. Depending on the needs of your particular organization, these state-of-the-art devices can be used to automate your production process, resulting in further time and cost savings based on:

- no metallization coatings needed / one step joining
- no flux clean-up
- no masking / alloys remains in joint



Mini S-Bonders

- Manual alloy application
- Applies pre-layers
- Uses ultrasonic agitation
- Applies alloys to local areas
- Melts alloy / completes joint
- Fills small joints / makes fillets



S-Bonder Roto-Oscillating Press



S-Bonder Ultrasonic Press





- accurately heats/cool joint surfaces.
- S-Bond™ alloy is preplaced.
- dies/tools fixture bonds precisely.
- applies accurate rotation/oscillation.
- controlled load cycle
- semi-automated / full process control
- fully automatable / integrates with pick and place units.

- semi-automated joining
- fully automatable
- full joint agitation with ultrasonics
- focuses energy to the joint
- high quality / joint strength
- clamps / positions
- u/s probes as fixtures
- works with pick-place units

applications & solutions

diversity in form, diversity in function

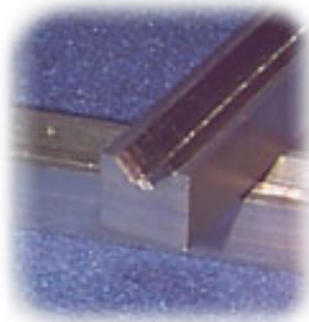
The attributes of S-Bond™ technology:

- air joining
- fluxless
- low joining temp.
- limited flow
- active bonds
- recycleable
- no metallization
- lead/cadmium free

provide advantages over brazing, epoxies, metal filled epoxies and metallized soldering. S-Bond™ is also significantly more thermally and electrically conductive than glues. S-Bond™ can be used as a "conductive" metal glue that can be continuously rejoined and recycled. As such, S-Bond™ has found application in joining...

LIGHT METALS

The low processing temperature of S-Bond™ makes it an ideal bonding agent for light metals such as copper and aluminum pipe fittings for refrigeration systems. In fact, with S-Bond™ even aluminum and steel can finally be joined in a single-stage process.



DISSIMILAR MATERIALS

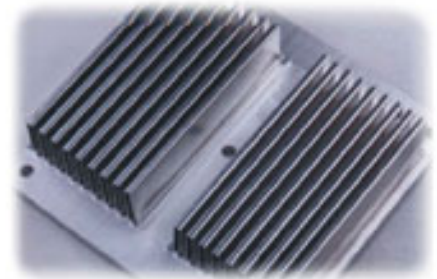
S-Bond™ joins many materials, is active and wets without coatings and joining at low temperatures that eliminates CTE mismatch problems that disrupt many joints. Also, as a

fluxless joining process, there are no incompatibility or contamination problems from chemical fluxes that



THERMAL MANAGEMENT

The control of expansion and the conducting of heat are critical design elements for making effective components that must manage heat flow and temperature in sensitive components from computers and chip packages to satellite-space platform electronics and avionics. S-Bond™ is a "conductive-metal glue" that can bond many of today's thermal management materials to themselves and in most combinations... copper, aluminum, Al-MMC's (w/ Al₂O₃ or SiC particles), AlN, Kovar®, Invar® or low CTE glasses Zerodur® in such forms as base plates, foams, and/or fins.



COMPOSITE MATERIALS

S-Bond™ alloys wets metals and ceramics making it suitable for metal:ceramic composites (MMC's). A strong niche for S-Bond™ has been shown to be aluminum matrix composites (Al-MMC) since aluminum wets and bonds so well and the ceramic particles are also able to be wetted by S-Bond™. S-Bond™ has also been demonstrated to wet and bond to ceramic composites (CMC's) including carbon:carbon (C:C) and carbon:silicon carbide (C:SiC).

GLASS TO METAL SEALS

S-Bond™ wets glasses without pre-coating making it





effectively work on only one of the joint materials, while possibly attacking the others.

without pre-coating, making it ideally suited for a variety of applications including the joining of sapphire to brass for laser windows.



FOAMED AND POROUS MATERIALS

S-Bond™ is able to wet foamed and porous materials without infiltrating the pores in the joints' base materials, making it a good match for applications such as sintered stainless steel filters, foam catalytic elements, foam heat wicks-surfaces. S-Bond™ has wetted and bonded copper, aluminum and graphite foams as well as most ferrous sintered materials.

MAGNETIC MATERIALS

S-Bond™ is well suited for a variety of magnetic joining applications, such as the bonding of magnetic material and steel in the production of drive shafts for electronic motors. In contrast to methods such as gluing, these joints are extremely resistant to aging and thermocycling.



S-Bond™

a unique material & process technology

S-Bond™ combines unique new materials with processes that enable joining while conforming to the geometries, logistics and production needs of the application.

Contact us for an update on our application and technological advances and order information.

Email or FAX us a description of your application. Please mention materials / service temperature and environment / strength or sealing requirements / any other physical joint properties required. Indicate your current joining process and describe why you are considering S-Bond™ technology. Also describe your production needs... All these considerations go into our decisions on which S-Bond™ alloy and process are most suitable to your needs and it permits us to offer an optimum solution.

Please contact us for any questions regarding how you can take advantage of S-Bond™ technology for your joining needs.

S-Bond™ technology is a joint development and product of Euromat GmbH and Materials Resources International. Depending on your location, need and application, we'll provide the resources required to assure your applications' success.

S-Bond™ Bonding Technology

Offering:

- Materials
- Process Equipment
- Production Systems
- Development services
- Pilot & production joining services
- Process and Design Engineering



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