

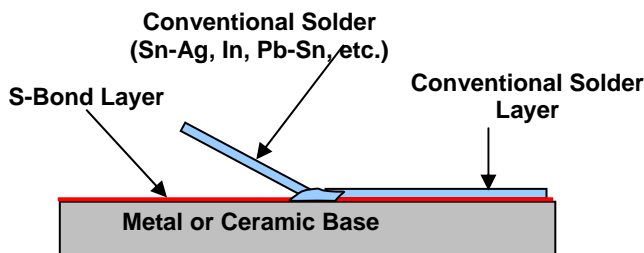
### S-Bond Active Solder Joining

S-Bond® active solders enable the joining of dissimilar metals and ceramics to each other and to other metals. S-Bond's patented alloys have active elements such as titanium and cerium added to Sn-Ag, Sn-In-Ag, and Sn-Bi based alloys to create a solder that can be reacted directly with the metal and/or ceramic surfaces prior to bonding. S-Bond joins...

- Directly, without the use flux.
- Without pre-plating steps, eliminating multiple step coating processes.
- At temperatures below 400°C, preventing distortion and softening of metals, thus preventing ceramic fracture.

Due to its active nature and the elements that have been added to all the S-Bond formulations, S-Bond alloys are 3-5 times the cost of conventional solders. For many small surface joining applications, the cost of S-Bond does not determine the total cost of the part. However, for large area bonds typical of sputter targets and heat sinks, the volume of S-Bond is important and must be limited to achieve superior bonding at minimum cost.

To minimize the cost of S-Bond joining of large surface areas, S-Bond Technologies (SBT) has developed and tested fluxless "hybrid" soldering techniques that maintain the benefits of S-Bond. In the hybrid processes, as the figure below illustrates, S-Bond solders are first spread as a thin coating onto the metal (aluminum, copper, titanium, stainless steel, etc.) and/or the ceramic based materials to "prepare" the surfaces for conventional solders to wet and adhere. To apply this thin layer, S-Bond is mechanically activated by various spreading methods such as brushing, rubbing, scraping, or ultrasonic spreading using various tools.

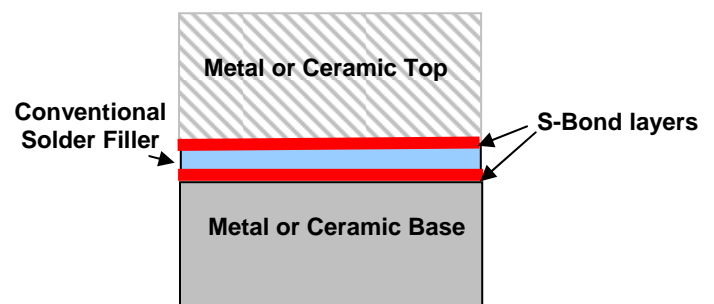


The objective is to coat the metal and/or ceramic surfaces with S-Bond to prepare the surfaces for molten conventional solders to adhere to without the use of flux. When joining large flat surfaces, these fluxes can become permanently entrapped leading to voids in the joint and/or to leaching of flux in subsequent operations.

Hybrid S-Bond joining processes eliminate the use of fluxes and have been shown to be more effective since it completely joins with the S-Bond filler metals. The methods that are recommended to minimize the use of S-Bond, yet still achieve fluxless joining are as follows...

- Heat base materials to S-Bond melting temperature.
  - Melt a small amount of S-Bond onto the joining surfaces.
  - Add ~ 0.1g/cm<sup>2</sup> to the opposing surfaces to be joined
  - Add S-Bond to the opposing joint surface.
  - Mechanically spread the S-Bond layer to completely cover the joint area (brush, spatula or ultrasonics).
  - Melt "conventional" solders onto the S-Bond layer on the bottom base and agitate to assure wetting to the underlying S-Bond layer.
- NOTE: Sn-Ag, Pb-Sn, Sn-Bi, In solders can be used
- Add enough "conventional" solder to the base to "float" and slide the top surface of the joint onto the conventional solder and provide excess solder to fill any gaps.
- NOTE: The sliding of the molten S-Bond / solder surfaces onto one another eliminates entrapped air and mechanically shears the surfaces of the S-Bond layer to the bottom "conventional" solder layer on the base.

The figure below shows how large area bonds can be made by using the supplemental conventional solder joining method compared to joining using 100% S-Bond filler. When bonding large areas, such hybrid joining techniques can save from 50-70% of the cost over using 100% S-Bond for the joint.



Please contact us to evaluate how supplemental S-Bond Bond joining methods can be implemented on your parts as a cost effective way of S-Bond fluxless joining. We would be pleased to demonstrate S-Bond's capability to meet both your large area bonding needs and costs requirements.