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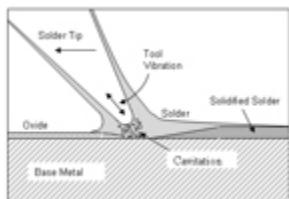


Figure 1 Illustration of cavitation during ultrasonic soldering.

Ultrasonic Soldering: A Green Technology for Electronics Applications

by EWI Engineers Shankar Srinivasan and Tim Frech

Since the European Union's Waste Electrical and Electronic Equipment (WEEE) and Restriction on Hazardous Substances (RoHS) directives became effective in 2005 and 2006, respectively, there has been a continuing trend in the electronics industry toward going "Green" for its components and products, for example, the use of lead-free solders, and the use of halogen-free substrates in the electronics packaging arena. EWI has made rapid advances in developing flux-less ultrasonic soldering technology that could help the electronics and other industries involved in taking electronics components along their path towards achieving "Green".

Conventional soldering in the electronics industry, be it manual, reflow or wave, requires the use of flux to prevent the formation of surface oxides to enable wetting of the solder to the base materials. In contrast, ultrasonic soldering is a flux-less joining process that consists of introducing high-frequency vibrations through a solder tool into the molten solder and inducing a cavitation action at the tool tip, as shown in figure 1. Upon near-contact of the tool tip with the base material, the cavitation forces disrupt and disperse surface oxides, thereby enabling solder wetting to the base metal. Thus, the oxide layer of the bonding surface is disrupted and removed by cavitation and not by the use of any fluxing agent.

Elimination of flux, which is the key advantage of the ultrasonic soldering process leads to many associated benefits during soldering in electronics applications, for e.g., in electronic components soldered to printed circuit boards: (1) Elimination of hazardous exposure, clean-up issues, and reduction of material costs; (2) Elimination of corrosion caused by flux entrapment; (3) Elimination of post-solder cleaning operations and cleaning material costs; (4) Maintaining dielectric constant of printed circuit boards, and (5) Improved wetting inside sharp corners and small crevices. Clearly, Ultrasonic Soldering is a Green Technology!

Through a cooperative research project (Report MR0806), EWI evaluated the suitability of using flux-less ultrasonic soldering for applications aimed at, but not limited to, those requiring structural integrity of the solder joint, for e.g., electronics packaging. Results from this project were very encouraging and showed that the shear strength (4 -5 ksi) of ultrasonically soldered Sn-3.0Ag-0.5Cu (SAC305) lead-free solder was similar to that of SAC305 fabricated by conventional flux-based soldering obtained under identical conditions on copper substrates with Immersion Silver and Electroless Nickel Immersion Gold surface finishes. The shear strength of SonicSolder™ was also similar to that of SAC305. SonicSolder™ is a EWI patented lead-free tin-rich binary alloy of tin and aluminum that melts at 231°C.

S-Bond Technologies has been licensed to make and use *EWI SonicSolder®*

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