Vibrations

ultrasonic industry association
UIA

News from the Ultrasonic Industry Association

Jeff Vaitekunas, Editor

Fall 2000, Vol. 10, No. 3

Note the following new address for the UIA as of November 17, 2000:
1111 North Dunlap Avenue
Savoy, IL 61874
Phone: (217) 356-3182 FAX: (217) 398-4119
Ask for the UIA Coordinator

The feasibility of flux-free ultrasonic soldering of aluminum and stainless steel by transmitting the ultrasonic energy through a solid medium is demonstrated

BY HAMID R. FARIDI, JACK H. DEVLETIAN AND HUE P. LE

A NEW LOOK AT FLUX-FREE ULTRASONIC SOLDERING

Due to the need for new flux-free soldering methods for the electronics industry, the state of the art in ultrasonic soldering is rapidly advancing. In this study, flux-free ultrasonic soldering of 2024 clad aluminum sheet and 304 stainless steel was conducted to determine the conditions that produce the highest shear strength in lap joints. Prior to this time, ultrasonic energy was always applied directly to the molten liquid pool to promote excellent coupling and wetting through cavitation of the substrate. Here, the ultrasonic energy was applied to a thick solid aluminum fixture, preheated to the soldering temperature and further transmitted through the substrate test sheets to form a lap joint containing solder.

Developments in Flux-Free Ultrasonic Soldering

Although ultrasonic soldering has been well known as a "fluxless" means of soldering since the 1940s, it was not until 1976 that Antonevich (Ref. 1) and Hunicke (Ref. 2) provided fundamental evidence of the mechanism of ultrasonic soldering. They showed that structural shapes of aluminum alloys readily "tinned" or wetted in a bath activated by ultrasonic energy without the aid of fluxes. Furthermore, Hunicke (Ref. 2) showed it was possible to wet stainless steel without flux by dipping into a zinc-based solder activated by ultrasonic energy. In 1988, Sherry (Ref. 3) patented the use of ultrasonic soldering as a coating method for electronic components. This technique produced solder bumps on silicon chips, chip carriers and circuit boards. The component was covered with a photoresist mask, but with the pads exposed. Then, solder was applied by immersing the component surface while ultrasonic energy was activated for 5 s in the bath, so the solder wetted the exposed aluminum pads. The mask acted as a mold for the solder to control the solder bump height (Ref. 3).

In 1998, the first outstanding application of ultrasonic energy for high-production soldering of

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Reprinted from Welding Journal , September 2000, Page 41-45

President's Message...Mark Schafer

Welcome (finally) to the 21st Century! As the millennia advance, so does the UIA. This year will be an exciting one for all our members, as we dramatically expand our meeting schedule.

First of all, we are planning a focussed medically-oriented meeting in May, which will bring together physicians, researchers, designers, and users. The goal is to highlight the application of high intensity ultrasound in medical applications. These range from tissue cutting to healing, contrast enhancement to drug delivery. With a single topic, the meeting will permit a full immersion for both the novice and the expert. Mark your calendars now.

While you have the calendar out, don't forget about our annual symposium, this fall in Atlanta. The symposium is being coordinated with the IEEE UFFC Ultrasonics Symposium to allow members of both organizations a chance to "see the other side" of ultrasound. This will allow the UIA to reach out to new members and allow our members access to new "connections."

All of these plans follow from our Vision Statement *to be the forum for manufacturers, users, and researchers in ultrasonic technology.* Look for more information in the months to follow. This year promises to be an exciting one for our organization!

... Mark Schafer, President

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UIA

31st Annual UIA Symposium

October 11 & 12, 2001

The Omni Hotel, Atlanta, GA

(immediately following the IEEE International Ultrasonics Symposium)

Call for Papers

Deadline for submission: March 1, 2001

The Ultrasonic Industry Association, Inc. invites you to submit a 200-word abstract for consideration of presentation at the UIA's 31st Annual Symposium.

Please check the appropriate category of your proposed presentation:

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- Cleaning
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- Cutting
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Deadline: March 1, 2001 for submitting *Call for Papers* Form

Important Information: Presentations will be no longer than 25-30 minutes; final abstracts (diskette or Email) and bio-sketches must be submitted to UIA Headquarters no later than August 1, 2001. The session chair will contact you directly to discuss your proposed presentation. *Accepted presenters receive a discounted registration fee.*

Chairpersons: Alan Broadwin, Ainslie, Phone: (914) 833-2649, Fax: (914) 833-5037, Email: broadwin@ainslie.com
Dr. Foster Stulen, BIOMEC, Phone: (513) 475-4082, Fax: (513) 475-4083, Email: fstulen@biomec.com

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through-hole joints during wave soldering of printed circuit boards was achieved without the need to apply flux (and subsequent flux removal after soldering) by Garrecht, *et al.* (Ref. 4), in Germany. This represented the first major breakthrough for the use of ultrasonic energy in a high-production electronic process. In addition to cost savings arising from flux-free and residue-free soldering, Kurtz (Ref. 5) showed ultrasonic soldering required far less nitrogen shielding gas to protect the copper during soldering. Biancini (Ref. 6); Chu, *et al.* (Ref. 7); and Ogashiwa, *et al.* (Ref. 8), developed ultrasonically assisted methods to produce solder bumps individually on flip chips without masks. In England, Saxty (Ref. 9) also reported ultrasonically wetted leads have improved solderability and resistance to aging compared with fluxed leads. Due to cavitation produced by ultrasonic soldering, gold plating could be removed thoroughly and quickly (Ref. 9).

Vianco, *et al.* (Ref. 10) performed an extensive study of the wetting and capillary action between two parallel sheets of copper when dipped into an ultrasonically activated bath. Owing to the requirement that solder must contact the laying surfaces to support the oxide removal (cavitation) process, capillary rise above the reservoir surface was not achieved. Although the ultrasonic energy was dispersed within the substrate body, the cavitation process could potentially operate on surfaces of the substrate that were not in line of sight of the ultrasonic horn. Vianco (Ref. 10) also showed that , to produce a joint, ultrasonic soldering required immersion of the substrate into the solder bath. Immersion in pure tin was shown to wet better than immersion in tin-lead alloys. In experiments using a point-source ultrasonic horn, they (Ref. 10) demonstrated oxide removal by means of solder cavitation resulted from a combination of mechanical erosion and coupling of the ultrasonic energy to the substrate geometry.

Hosking, *et al.* (Ref. 11), presented ultrasonic soldering as a materials- and geometry-dependent advanced process. They indicated both mechanical erosion and sound-wave propagation within the substrate cause the oxide removal. In fact, it can be implied the mechanical properties of the substrate itself affect wetting of the substrate surface by the molten solder.

Inaba, *et al.* (Ref. 12), developed an ultrasonic soldering method for forming solder bumps on aluminum electrodes in Si wafers. Before applying ultrasonic energy, the Al pad was covered by a thin, porous Pd layer, and then a thin layer of Ni-P was selectively formed on the Al pads using the electroless plating technique (Ref. 12). In 1996, Miyake, *et al.* (Ref. 13), patented the use of ultrasonic soldering for joining metals by applying an ultrasonic vibration through the metal members.

The objective of this article is to show the feasibility of producing ultrasonically soldered lap joints by the transmission of ultrasonic energy through not only the thin substrates

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of the lap joint but also a thick aluminum fixture assembly used to provide clamping and heating of the solder joint. Flux-free ultrasonic soldering of large surfaces in lap joints of thin aluminum and stainless steels were the major concerns of this study.

Experimental Procedures

The materials used were 2024 clad aluminum sheet and 304 stainless steel with thickness of 0.81 mm (0.032 in.) and 0.64 mm (0.025 in.), respectively. All the fluxless ultrasonic soldering tests were preformed on rectangular coupons, with dimensions of 50 x 25 mm (2 x 1 in.). Ultrasonic soldering operations were performed using an ultrasonic welding machine with output power of 1500 W and output frequency of 20 kHz. Shear test specimens are shown in Fig. 1. Shear testing was carried out in the stroke-controlled mode of a tensile testing machine. Soldering was conducted in air as well as in an argon atmosphere. To determine the effect of surface preparation on joint strength, the following surface preparations were investigated: degreased, chemically cleaned, tin-plated with a subsequent addition of 70Sn-30Pb solder filler metal, and tin-plating without subsequent solder filler metal addition. Other variables, such as ultrasonic soldering time, soldering temperature and shielding gas, were investigated. The degreased coupons were ultrasonically cleaned in deionized water for 15 min at room temperature. The chemically cleaned aluminum coupons were immersed in an alkaline solution containing 75 g (2.63 oz) of sodium hydroxide and 4 g (0.14 oz) of sodium phosphate in 4 L of deionized water at 65°C (149°F) for 25 s. Prior to soldering, the stainless steel coupons were chemically cleaned in a nitric-acid-based etching solution.

The ultrasonic soldering tests were performed by contacting the horn directly to the upper fixture, which was preheated by four heater cartridges embedded in the fixture assembly (Fig. 2) in the range of 200-300°C (392-572°F). The 70Sn-30Pb filler metal was placed between the two aluminum or stainless steel test coupons, which were then placed between the upper and lower heated fixtures. When the prescribed soldering temperature was reached, the ultrasonic energy was applied to the upper fixture above the joint area and the molten solder. Ultrasonic soldering tests were performed under a constant 50 lb/in.^{2} pressure on the lap joint and held for 3-12 s. The solder alloy used in this study was the near-eutectic (Sn-rich) 70Sn-30Pb composition, which has a freezing range of approximately 192-183°C (377.6-361.4°F).

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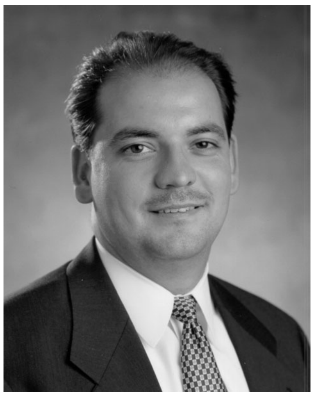
In the News...

Stapla Ultrasonics Appoints New Business Manager



Juergen Gaebler has joined Stapla Ultrasonics Corporation, a leading manufacturer of ultrasonic welding systems, as Business Manager, Plastic Welding Products.

According to Stapla's President, Saeed Mogadam, Gaebler will be responsible for building and managing Stapla's plastic welding business. "With the introduction of our new K1 Ultrasonic Plastic Welding System, Stapla is bringing advanced ultrasonic technology and technical support originally developed to solve high-precision metal welding problems found in automotive, medical/biotech and electronics manufacturing to the plastics industry."

Prior to joining Stapla, Gaebler was Business Manager for Herrmann Ultrasonics, responsible for strategic business development throughout the Eastern United States. "With his proven record of establishing business relationships with Fortune 500 companies in the medical, electronics, and automotive industries, Gaebler has the engineering and business background needed to support the introduction of advanced ultrasonic welding technology to the plastics industry. This technology enabled Stapla to become the leader in ultrasonic metal welding with more installations than any other manufacturer.

Gaebler holds degrees in mechanical engineering and accounting from KIB-Erfurt and the University of Hamburg. In addition, Gaebler is currently pursuing a degree in international business.

Stapla Ultrasonics is a key supplier of ultrasonic welding equipment to the medical, automotive, packaging, plastics, computer, electronics, and telecommunications industries.

For more information, contact Stapla Ultrasonics Corporation at 375 Ballardvale Street, Wilmington, MA 01887, Phone: 978-658-9400 and Fax: 978-658-6550, Email: info@staplaultrasonics.com.

In the News...

Sono-Tek Acquires Assets of SEREC Corporation

Sono-Tek Corporation announced that it acquired the assets of SEREC Corporation, a Rhode Island-based company, which developed and patented a unique *Airless*™ technology with applications in solvent cleaning systems, coating processing, food processing, and other manufacturing processes. SEREC's machines have been customized and sold to companies in the aircraft, tube drawing, and metal stamping industries. The assets acquired include SEREC's patents, trademarks, engineering, financial and customer records, certain machines, parts inventory, test equipment, and existing purchase orders, some of which Sono-Tek expected to ship during its third fiscal quarter, which ended November 30, 2000.

Peter T.E. Gebhard, Founder and President of SEREC, will provide assistance to Sono-Tek to effectuate the orderly transfer of these assets, as well as supporting the short-term sales and marketing activities. Mr. Gebhard will also assist in developing a long-term strategy for the entire solvent cleaning business of Son-Tek Cleaning Systems, Inc.

According to James L. Kehoe, Chairman and CEO of Sono-Tek, "We believe SEREC's revolutionary *Airless*™ systems are unique because they reduce organic solvent emissions to a level well below the most stringent level set by the U.S. Environmental Protection Agency. This technology should provide significant growth opportunities for Sono-Tek because of its performance advantages and restrictions being imposed on competing technologies by more stringent enforcement of environmental legislation."

Mr. Kehoe continued, "We believe this acquisition is synergistic with the business of Sono-Tek Cleaning Systems, and that by combining SEREC's business with our more substantial resources in engineering, sales, and finance, we will be able to increase SEREC's growth in existing markets, as well as its expansion into new markets."

Sono-Tek Corporation is the leading developer and manufacturer of liquid spray products based on its proprietary ultrasonic nozzle technology. Founded in 1975, the company's products have long been recognized for their performance, quality, and reliability. Sono-Tek Cleaning Systems, Inc., a wholly owned subsidiary of the company, is a leading developer and manufacturer of precision cleaning and drying products for the semiconductor, disk drive, and other precision cleaning industries. PNR America, LLC, an affiliate of the company, imports and sells a full range of pressure nozzles manufactured in Italy.

Bright Engineering Established

Charles Bright, PE, has established Bright Engineering, Inc. in Ames, Iowa. This consulting firm focuses on dynamic electro-mechanical systems, particularly those that couple electrical power to vibration, motion, or sound. Special emphasis is placed on transducers using shape change materials. For details, visit www.bright-engineering.com or for more information contact Charlie Bright, Phone: 515-663-9942 or Email: charlie.bright@ieee.org

Acquisition by Morgan Electro Ceramics

Morgan Electro Ceramics has purchased the piezoelectric business of Philips in Eindhoven, Holland. The acquisition will add significantly to the core products of MEC as well as their engineering and added-value offerings. This now brings Morgan Electro Ceramics to four piezoelectric manufacturing sites total, all ISO certified. MEC also produces microwave ceramics and ceramic capacititors in their Ruabon, Wales facility. Ultrasonics is a primary market sector focus of Morgan.

A New Look at Flux-Free...

The first series of soldering tests was performed with a constant soldering time of 4 s, at the soldering temperatures of 200, 230, 270 and 300°C (392, 446, 518 and 572°F) for the specimens with different surface conditions, in air as well as in argon. In the second series, the soldering temperature was kept constant at 230°C and the soldering times were established for 2, 4, 8 and 12 s by maintaining the same soldering parameters as used in the first series. The cooling rates were kept approximately constant at 5°C/min.

Ultrasonic Soldering of Aluminum

When 2024 clad aluminum sheet specimens were ultrasonically soldered at temperatures from 200 to 300°C in air (without flux) for 4 s, the chemically cleaned specimens developed the highest joint shear strength followed by tin-plated with 70Sn-30Pb filler metal addition, degreased specimens and tin-plated without a filler metal addition—Fig. 3. In Fig. 3, both degreased and chemically cleaned aluminum specimens increased joint strength with increasing soldering temperature. In fact, the chemically cleaned specimens ultrasonically soldered at 300°C nearly equaled the shear strength of the bulk solder (5500 lb/in.^{2}). On the other hand, the tin-plated specimens with and without filler metal addition always decreased in shear strength with increasing soldering temperature from 200 to 300°C. When the 2024 clad aluminum sheet was only tin plated and then soldered at 200°C, the resulting strength of the solder joint approached zero because the melting temperature of Sn (232°C [449.6°F]) was higher than the soldering temperature. When the soldering temperature was raised to 230°C, excellent joint strength resulted. At a soldering temperature of 300°C, the joint strength diminished to only 400 lb/in.^{2}. The reason for the loss of strength at the elevated soldering temperatures was the de-wetting that occurred due to the rapid oxidation of the molten tin plating. Significantly improved shear strength resulted when the tin-plated aluminum specimens were ultrasonically soldered using the low-melting 70Sn-30Pb filler metal as shown in Fig. 3. Since the liquids and eutectic temperatures of the filler alloy were 200 and 183°C, respectively, excellent joint strength was achieved at 200°C. With increasing soldering temperature up to 300°C, a gradual reduction in strength occurred due to oxidation of the solder.

When ultrasonic soldering was performed in an argon atmosphere (instead of air), substantially improved shear strength values were recorded for all surface preparations—Fig. 4. In fact, solder joints with all surface preparations resulted in improved shear strength with increasing soldering temperature. The positive slope in the curves show de-wetting due to oxidation was completely eliminated. Again, the chemically cleaned surface provided the best wetting of the 70S-30Pb solder and the best joint strength, particularly at elevated soldering temperatures.

Ultrasonic soldering was also performed at 230°C in air for different soldering times as shown in Fig. 5. The results show that increasing the soldering time from 2 to 4 s increased the joint strength substantially for the degreased specimens. However, further increases in soldering time from 4 to 12 s had little effect on joint strength. This was not the case for the tin-plated specimens, which showed a steady increase in strength with increasing ultrasonic soldering time. For the tin-plated and

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solder-added specimens, there was an increase in the joint strength with increasing soldering time. The results also showed the joint strengths were higher than those without solder. This is because the shear strength of the bulk 70Sn-30Pb solder was greater than that of the pure tin. Significant improvement in shear strength resulted when the chemically cleaned specimens were soldered. This showed the deoxidation of the aluminum surface prior to ultrasonic soldering was effective. At the same time, there was a significant increase in strength with increasing soldering times (3 and 12 s) where the shear strength reached 6000 lb/in.^{2}. These results again confirmed that, in the absence of a thick oxide film, increasing the ultrasonic soldering time was beneficial to joint strength.

For the aluminum specimens soldered ultrasonically in argon at different soldering times with different surface preparations, the results showed the argon shielding was greatly beneficial—Fig. 6. The inert gas shielding provided by argon produced substantial improvements in joint strength for the tin-plated specimens, which were more susceptible to oxide contamination.

Ultrasonic Soldering of 304 Stainless Steel

For degreased and chemically cleaned stainless steel specimens, ultrasonic soldering resulted in virtually no joint strength regardless of soldering temperatures or soldering times—Figs. 7, 8. This was also true for soldering performed in an argon environment—Figs. 9, 10. In this case, the rate of reformation of Cr_2O_3 apparently was so rapid after chemical cleaning that wetting by the molten solder was impossible even with ultrasonic action. Ultrasonic energy was not able to rupture the freshly formed Cr_2O_3 layer on the surface. It may be impractical to chemically clean stainless steel and expect any wetting by molten 70Sn-30Pb solder unless the cleaning, transportation to the soldering station and subsequent ultrasonic soldering are conducted in a protective environment. The tin-plated stainless steel samples, soldered ultrasonically with or without the filler metal in air at different temperatures, showed some strength particularly at the lower soldering temperatures. The severity of oxide formation and growth on the tin-plated surfaces caused some continuous reduction in strength of the joints with increasing soldering temperature. Soldering the tin-plated specimens in argon resulted in increasing strength with increasing temperature. Tin-plated stainless steel specimens soldered in air without adding the filler metal exhibited increasing strength with increasing soldering time from 4 to 12 s at a low soldering temperature of 230°C. When protected with argon shielding, strength increased with increasing ultrasonic soldering time.

Discussion

The shear strength of tin-plated aluminum and stainless steel specimens ultrasonically soldered with the addition of 70Sn-30Pb filler metal was higher than that of the tin-plated specimens without solder additions. The reason was the difference between the strength of the 70Sn-30Pb solder and the pure tin bulk materials. The shear strength of the bulk solder (70Sn-30Pb) was about 38 MPa (5500 lb/in.^{2}) compared to that of pure tin, which was around 20 MPa (2900 lb/in.^{2}). The results also showed the shear strength of the ultrasonically soldered tin-plated aluminum specimens was higher than the tin-plated stainless steels with or without filler metal. This was mainly because of the differences between the mechanical properties of the substrate materials. The 2024 clad aluminum alloy had a lower modulus of elasticity and strength than the 304 stainless steel. Experimental observations suggested the efficiency of the ultrasonic activation for removing the oxide films depended as strongly upon the bulk properties of the substrate as on its surface conditions. The faster growth rate for the chromium oxide film was probably the most valid reason for explaining why the chemically cleaned stainless steel specimens, which were joined using ultrasonic energy, had virtually no strength. The opposite argument may also be useful for explaining the very significant success when chemically cleaned aluminum specimens were ultrasonically soldered. The joint strengths of some chemically cleaned aluminum specimens were even higher than the strength of the bulk solder itself, such as the specimen soldered at 230°C for 12 s in the air. This was also the case when the protective environment (argon gas) prevented further oxidation and thickening of the oxide layer on the substrate surface during the soldering operation. This is the reason behind the more successful wetting and higher strength when the argon gas was used. Therefore, breaking down the oxide layer, the strength of the bulk solder and the shielding environment had significant effects on the solder joint strength as shown through this study for both aluminum and stainless steel specimens. Overall results confirmed tin plating was a simple solution to an old problem of soldering difficult-to-solder materials, especially when the flux was not used. Ultrasonic soldering also proved to be a doable method in a vast domain from microelectronics to refrigeration. It is an easy and clean operation that is applicable even for complex geometrics.

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New Products...

New Ultrasonic Autoshunt Welding System Automates Production

Stapla Ultrasonics is introducing the Autoshunt ST30, a fully automatic wire processor for making shunts in a wide range of dimensions in single and double (pigtail) configurations.

Designed especially for automatic operation in high-volume production environments, the Autoshunt combines Stapla's state-of-the-art Moskito ST30 ultrasonic welding system with wire handling components. Modular sub-systems simplify set-up and maintenance and make it easy to adapt the system to meet different customer requirements.

The system feeds a measured length braided copper wire from a reel to the ultrasonic welder that solidifies the wire to an exact dimension. The nugget, or weld, is then cut, and the finished shunt is dropped into a bin.

The system will automatically produce shunts ranging from 1 to 12 inches in length and pigtails from 1.5 to 12 inches. It can accommodate wires from 20 to 4 gauge. Standard nugget lengths before cutting range from ¼ to ¾ inches.

The entire process runs under microprocessor control. The Stapla ST30 controller provided with the system is used to set and control the desired welding parameters—energy, time, and compaction. The controller's built-in memory holds 999 data sets. This, together with a simple exchange system for welding tools, allows quick changeover from one job to the next.

For more information, contact Stapla Ultrasonics Corporation at 375 Ballardvale Street, Wilmington, MA 01876, Phone: 978-658-9400, Fax: 978-658-6550, or Email: info@staplaultrasonics.org.

PHILTEC, Inc. Announces Model UV40 Ultrasonic Vibration Meter

PHILTEC is proud to announce the latest addition to their Fiberoptic Displacement Sensor product line: Ultrasonic Vibration Meters. Model UV40 displays the peak-to-peak amplitude of vibration within the passband 5 kHz-120 kHz. Developed as a production gaging tool with the non-contact fiberoptic sensing head securely fixtured, Model UV40 Meters deliver a low-cost solution for production testing of utlrasonic equipment.

When fitted with an accessory collar, which enables handheld contact measurements, the unit can be used, in a diagnostic sense, to scan and measure vibration amplitudes at various locations on equipment surfaces. In the words of Tim Boron, Ultramer Inc., "Everyone in this industry should have at least one of these…"

For more information; contact Fran Katcef at 800-452-6242, fax: 510-757-8138, Email: UV40@philtec.com. Also visit the PHILTEC website at www.philtec.com.

Sono-Tek Ships Series 5000 Cleaning Systems

Sono-Tek announced that its wholly owned subsidiary, Sono-Tek Cleaning Systems, Inc. (SCS), has shipped the first of its new Series 5000 Cleaning Systems to a major 300 mm IC device manufacturer. The Series 5000 non-aqueous cleaning system is a major advance in cleaning and drying technology for wafer and disk transport and storage containers.

According to Steven Harshbarger, VP of Sales & Marketing, "We believe that the delivery of these first systems will become a significant milestone in the history of the company by positioning us as the leader in the resurging semiconductor capital equipment market. The System 5000 family of cleaning systems has been thoroughly designed and tested to meet rigorous industrial standards."

The Series 5000 non-aqueous cleaning system is a major advance in cleaning and drying technology for wafer and disk transport and storage boxes (FOUPs, FOSBs, and SMIF Pods), featuring both high cleaning efficiency and rapid throughput. It is in full compliance with CE and SMI standards, S2-93A and S8. The tool is capable of cleaning transport and storage containers from all manufacturers of 150-mm, 200-mm and 300-mm wafer carriers.

Because the system does not require DI water, the production and disposal costs associated with aqueous systems are eliminated. The non-aqueous cleaning material is constantly recycled using an onboard reprocessor, thereby minimizing fluid consumption. Cost-of-ownership models demonstrate that the Series 5000 cleaning system compares favorably with aqueous cleaning systems.

Sono-Tek Corporation is the leading developer and manufacturer of liquid spray products based on its proprietary ultrasonic nozzle technology. Founded in 1975, the company's products have long been recognized for their performance, quality, and reliability in a variety of industries including semiconductors, electronics assembly, and medical devices. SCS is a leading developer and manufacturer of precision cleaning and drying products for the semiconductor, disk drive, and other precision cleaning industries.

For more information contact Steve Harshbarger, V.P. Sales & Marketing, at 845-795-2020.

New Products...

Sonobond Ultrasonics Introduces New Digital Metal Spot Welder

Sonobond Ultrasonics introduced its newest metal spot welders, the SonoWeld™ Series, at the Assembly Technology Expo, September 26-28 in Rosemont, IL. This new series of multifunctional welders offers a number of unique features never before incorporated in a single welder.

The SonoWeld Series is an easy-to-use, microprocessor-controlled metal welder that can perform spot welds in a single pulse with repeatable accuracy and with additional tooling, can also provide wire-to-terminal welding. It is the only ultrasonic welder that can join up to 10 stranded wires from a flat flexible circuit to multi-connection terminals in a single pulse. Although originally developed for automotive parts assembly, the SonoWeld series has applications in many other industries, including electrical, electronic, appliances, and communications equipment.

With a microprocessor built into the power supply, Sonobond's SonoWeld equipment can store and recall up to 250 weld protocols from memory. The power supply utilizes a rugged amplifier design based on pulse width modulation and comes equipped with a feedback loop in the directional coupler to control output power. Available in 1500-and 2500-watt models, each SonoWeld unit has a RS232 port to transfer weld information to a computer, where it can be saved to a database, spreadsheet, or diskette.

The SonoWeld series features a user-friendly design, allowing the operator to control and recall weld parameters directly from a digital display located on the front panel of the controller/power supply. The operator selects a welding mode in time, energy, or height and can also input automatic quality-control features to ensure 100 percent quality monitoring. The operator is alerted when variables exceed preset power and time limits or if the height of a part is different from that originally set. In addition, the SonoWeld features automatic frequency control and overload protection and can also detect and prevent wrong-part or no-part welding.

The SonoWeld Series uses Sonobond's patented Wedge-Reed coupling system of high clamp force and low vibratory amplitude to direct ultrasonic energy that disperses oxides and surface films on the workpieces. This provides a metal-to-metal contact point, forming a true metallurgical bond without fusion. According to Janet Devine, President of Sonobond Ultrasonics, "Our Wedge-Reed system ensures precise, dependable bonding of electrical components. It is especially useful for applications requiring multiple wire-to-terminal welding, because it can weld multiple wires in a single pulse."

The SonoWeld series creates strong welded joints, and it operates without the need for fluxes, filler material, or other consumables. The system features heat-treated tool steel Taper Lock Tips, which provide the easiest setup and quickest tooling change of any ultrasonic metal welder in the industry. Says Devine, "Manufacturers prefer the SonoWeld system because it is so easy to operate. The Taper Lock Tips can perform up to 300,000 welds and can be inserted without using a wrench. In addition, the system was designed to eliminate alignment problems. With the SonoWeld, there is no need for the operator to rotate the entire sonic system to line up the part. It is automatically aligned by virtue of its design."

Sonobond Ultrasonics is a member of the Inductotherm family of companies. In 1960, Sonobond, formerly known as Aeroprojects, received the first patent ever awarded for ultrasonic metal welding, and today it continues to be a worldwide leader in the application of ultrasonic bonding technology. Sonobond also provides ultrasonic bonding equipment for textile and plastic assemblies.

For more information, please call Janet Devine, President, at 610-696-4710.

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Conclusions

This study was performed to examine the use of ultrasonic activation for soldering of aluminum and stainless steel without the need of a fluxing agent by transmitting the ultrasonic energy through a solid medium. The results can be concluded as follows:

1) Fluxless ultrasonic soldering of aluminum and stainless steel lap joints by transmitting ultrasonic energy through a solid clamping fixture and solid substrate is feasible.
2) Joint shear strength is influenced by the soldering temperature, the soldering time, substrate surface condition and shielding gas environment.
3) Highest joint strengths are achieved for the chemically cleaned aluminum specimens. Aluminum can be ultrasonically soldered on surfaces that have been chemically cleaned, degreased or tin plated. Stainless steel can only be ultrasonically soldered on Sn-plated surfaces.

References

1. Antonevich, J. N. 1976. Fundamentals of ultrasonic soldering. *Welding Journal* 55(7):200-s to 207-s.
2. Hunicke, R. L 1976. Ultrasonic soldering pots for fluxless production soldering. *Welding Journal* 55(3):191-194.
3. Sherry, W. August 1998. Soldering of Electronic Components. U.S. Patent No. 4763829, AT&T Bell Laboratories.
4. Garrecht and Ewald. June 1998. Device for Fluxless Soldering. U.S. Patent No. 5762257, Ersa Lottechnik GMBH.
5. Kurtz, R. 1995. Ultrasonic replace Dva. *Electronic Production* 24(7):17-21.
6. Biancini, J. A. 1993. Chip mounting technology. *Surface Mount International* 1:17-34.
7. Chu, D. W., and Shen, D. S. 1993. Maskless flip chip solder bumping technique. *Proc. of 43rd Electronic Components and Technology Conference*, IEEE, New York, N.Y., pp 610-614.
8. Ogashiwa, T., Arikawa, T., Murai, H., Inoue, A., and Masumoto, T. 1995. Reflowable Sn-Pb bump formation on Al pad by a solder bumping method. *Proc. of 45th Electronic Components Technology Conference*, IEEE, New York, N.Y., pp 1203-1208.
9. Saxty, P. 1995. Ultrasonic soldering in the electronics industry. *Metallurgia* 62(8):287.
10. Vianco, P. T., Hosking, F. M., and Rejent, J. A. 1996. Ultrasonic soldering for structural and electronic applications. *Welding Journal* 75(11):343-s to 355-s.
11. Hosking, F. M. 1992. Fluxless soldering as an environmentally compatible manufacturing alternative. *International Journal of Environmentally Conscious Manufacturing* 1(1):53-64.
12. Inaba, M., Yamakawa, K., and Nobuo, I. 1990. Solder bump formation using electroless plating and ultrasonic soldering. *IEEE Transactions on Components, Hybrids, and Manufacturing Technology* 13(1):119-123.
13. Miyaka, *et al.* 1996. Process of Joining Metal Members. U.S. Patent No. 5511719. Nippondenso Co., Ltd., Kariya, Japan.