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SMTA
Surface Mount Technology Association

December 2015

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EDITOR'S NOTE

Observations from productronica 2015

by Stephen Las Marias
I-CONNECT007

Perhaps I could consider it a milestone. For the past decade I have been familiar with productronica, through editing articles and press releases about exhibitors' technologies. But it's only this year, the event's 40th year, that I was able to go to Munich, enjoy the cold weather—which, according to most people I met at the show, was the hottest one yet—and see what productronica really is like.

And it was just as I expected. It was so big that four days weren't enough to really cover it all. Taking up seven halls of the Messe Munchen—Halls A1 to A4 and B1 to B3—productronica was massive in terms of PCB and SMT equipment and systems technology showcase. From materials to equipment to software, the show provided a snapshot of the technologies behind the global electronics manufacturing and production industry.

While some people said there weren't really any new "Wow!" technologies, the show featured interesting innovations designed to make PCB production and assembly more efficient, of higher quality, and as fast as possible (reduced cycle times). From the latest innovations in dispensing technology to inspection and vision systems, higher performance solder materials and solder masks, new conformal coatings and adhesives, even state-of-the-art squeegees and cabinets, it was a lot to take in for a first-timer like me.

Apart from the equipment and materials showcase, what I observed during the four days of running from hall to hall to talk to customers and partners, were the proliferation of robotics systems and automation. More and more electronics manufacturers seem to have been adopting collaborative robots to further improve their manufacturing processes—that is, based on the number of robotic systems I've seen around the show floor. (One robot stationed at the entrance to the exhibition center danced to the tune of "Gangnam Style.")

Another noticeable trend was automation. Everywhere you looked, banners and posters proclaimed multiple reasons behind the need

OBSERVATIONS FROM PRODUCTRONICA

for automation in production lines. Of course, this is not new; for crying out loud, pick-and-place machines are, first and foremost, automated systems. Dispensing systems, reel-to-reel technologies, inspection systems, reflow ovens—these systems are already automated.

Then why the automation trend? Perhaps because there are still smaller manufacturers who employ manual labor to do through-hole-component placement, or manual soldering—processes that, using these new technologies on showcase, can be transformed to make them faster, more efficient, and with as little (human) error as possible.

I also think that the automation trend is part of the move towards creating systems of integrated systems—enabled by the industrial Internet of Things (IoT), data and analytics—that will really help electronics manufacturers take their production to the next level, or next phase of industrial evolution.

This leads me to Industry 4.0, a big theme at this year's productronica. Industry 4.0, the smart factory, and cyber-physical systems—trends that are expected to transform the current electronics manufacturing environment—were featured at the Future Markets cluster. There, attendees were able to get more insights on the Industry 4.0 concept—complemented by VDMA Productronic's augmented and virtual reality show, which helped visualize various application scenarios on different electronics manufacturing machines.

On top of these technology innovations at the show, the IPC hand soldering competition, which I was able to watch, reminded me of my own experience, soldering different components and assemblies for projects during my university days (and the metallic sweet smell of lead-based solder, which is not good.)

Overall, productronica 2015, attended by about 38,000 visitors from nearly 80 countries, was a success. It was a great show for me as well, and I hope to attend the next one in 2017. I believe most of the future technologies showcased this year will be implemented in production facilities by then.

Moving on to our last issue for the year, we're happy to feature the SMT and electronics manufacturing industry associations, and illuminate how they are helping their members' journey to success.

First, we have Bill Barthel, president of the Surface Mount Technology Association (SMTA), discussing the association's conference offerings and various opportunities for members; longtime SMTA Executive Administrator JoAnn Stromberg's pending departure; and the way forward for the association. In another article, Tanya Martin, director of operations at SMTA, who will take the baton from JoAnn, discusses SMTA's activities, programs, and how to best serve its membership.

Next, we have IPC President and CEO John Mitchell, who explains the association's goals and basic mission, activities, and how it pro-

OBSERVATIONS FROM PRODUCTRONICA

motes technology development in the industry through standardization.

At productronica, I spoke with Keith Bryant, chairman of SMART Group, about the association and how it is helping companies cope with the challenges of surface mount technology, and promoting advanced manufacturing technologies. You can read my interview inside.

Dr. Eric Maiser, managing director of productronics—a sector group under the Electronics, Micro and Nano Technologies sector association of VDMA (Verband Deutscher Maschinen- und Anlagenbau – German Engineering Federation)—discusses the group's composition, its activities and its services for its members in the electronics manufacturing industry.

We also have Bill Bader, CEO of iNEMI, discussing how iNEMI formulates its roadmap for the industry, including some of the consortium's milestones in terms of the role it played in the transition to lead-free, addressing tin whisker growth, and moving towards HFR-free PCB materials.

I also interviewed Arthur Tan, chairman of the Semiconductor and Electronics Industries in the Philippines Inc. (SEIPI), about the association, its main goals and vision, and how it helps members in their journey from being local manufacturers to becoming global players in the electronics manufacturing field.

Of course, we still have our lineup of technical articles. From Siemens, we have Jorey Guzman's piece on digitalization and smarter manufacturing. He writes that as manufacturers look to the future, they need to examine how advanced information and communication technologies can boost their value creation.

Steven Grabey of Heraeus Electronics, meanwhile, writes about the versatility of polymer thick film materials and their advantages, such as low-temperature processing, quick curing, and the ability to offer many of the same benefits as high-temperature, thick film material without the need for the traditional firing step.

Integrated Micro-Electronics Inc.'s Frederick Blancas looks at the future of the EMS industry, and the opportunities and challenges to expect in the next year.

My colleague, Patty Goldman, technical editor of *The PCB Magazine,* interviewed Lenora Toscano, OEM director for MacDermid's electronics solutions division, about her company's dedication to fully understanding the needs of the end-user market of PCBs, her own role at the company, and the benefits that both she and MacDermid bring to SMTA and IPC meetings.

SMT Magazine isn't complete without our expert columnists. For this issue, Bob Wettermann of BEST Inc. writes about the several ways to remove solder mask selectively from a PCB. DDM Novastar's Robert Voigt, meanwhile, continues his piece on selecting a wave soldering system. (We continue to accept columnists for the magazine. If you are interested, just shoot me an email.)

Finally, all of us here at *SMT Magazine* would like to take this opportunity to thank our readers, customers, partners, and contributors for being with us throughout this year.

We wish you a wonderful Holiday Season, and we look forward to working with you next year! **SMT**

Stephen Las Marias is managing editor of *SMT Magazine.* He has been a technology editor for more than 12 years covering electronics, components, and industrial automation systems.

SMTA: Working Hard for the Global Industry

by Patty Goldman
I-CONNECT007

While at SMTAI recently, I spoke to SMTA President Bill Barthel, who is currently serving his second term to this elected position, and also happens to be the quality solutions manager at Plexus Corp. Our conversation covered quite a bit of territory, from conference offerings, to the pending departure of longtime SMTA Executive Administrator, JoAnn Stromberg, to the various opportunities for members, from students to corporate level managers and owners around the globe.

***Patty Goldman:** Thanks for spending a few minutes with me, Bill. Please begin by giving our readers an overview on SMTA.*

Bill Barthel: To start, SMTA is celebrating its 31st year. When manufacturing began the switch to automated SMT placement there really were not many resources for professionals to tap into when they needed technical guidance or assistance with issues. The SMTA was born out of that need. It became a resource where people could seek help, education, and professional advise from their peers regarding this trend called surface mount technology. I think our mission statement sums up our objectives well:

The Surface Mount Technology Association (SMTA) is an international network of professionals who build skills, share practical experience and develop solutions in electronic assembly technologies, including microsystems, emerging technologies, and related business operations.

The Association was a great concept at the time of its inception and it certainly remains a great concept now, because there's so much changing in this industry year after year. Where you and I are sitting, Patty, is our biggest event of the year. It's a huge technical conference—the best in the world, we claim and we'll defend—for the surface mount and electronics assembly industry. Then there are over 180 exhibitors here on the show floor who provide the real solutions. Technical leaders are drawn here, figuring out solutions for new technologies. Attendees can come to meet directly with the people that help put these solutions in place.

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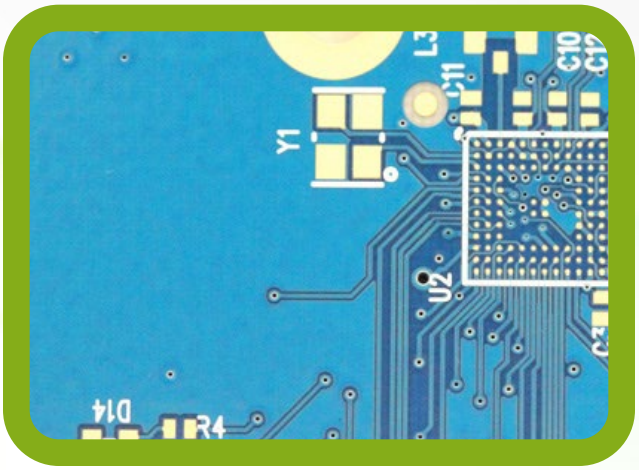

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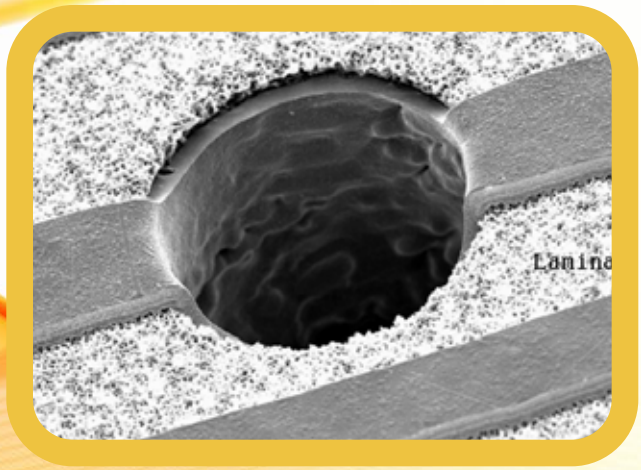

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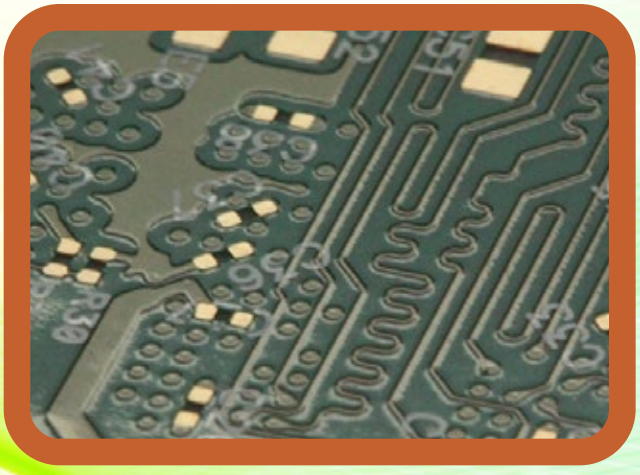

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***Goldman:** Besides putting on the conference, I know you have local chapters. Do some of the chapters do smaller shows?*

Barthel: Absolutely. Over half of our 50 chapters organize a regional expo and technology forum which really benefits those who sometimes aren't able to travel to the larger trade shows and conferences. This is our largest event, so we get people from many countries. It's held once a year, and as you can see, this is a pretty big deal; however, our foundation is the chapters. Our chapters provide an opportunity for members to meet locally with people that have the same interests to network, support, educate and be educated.

SMTA has chapters around the world. SMTA International, as well as the smaller local events, doesn't include just the papers and presentations —we offer half day workshops, training, facility tours, social events, and much more. Our chapter programming really addresses every stage of experience level Many times these technical forums are paired with an exposition. We are always looking for ways to support our mission as well as educate and assist our members – and have fun along the way!

***Goldman:** Speaking of experience, I understand that SMTA has student chapters. What can you tell me about that?*

Barthel: Yes, we have student chapters, with individuals who aren't sure of their future career direction and may not even be aware of what is available to them. We have seen a lot of growth lately in student chapters. We expose them to the electronics industry, and show them what the association can offer, which includes a Career Center here at SMTAI. In addition job openings in the industry as well as postings by people looking for opportunities

Bill Barthel, SMTA President.

can be found on our web site, www.smta.org. It's free to members.

***Goldman:** You mentioned the technical papers. How does that work?*

Barthel: Every paper that's published is expected to be unique work. We have a dedicated technical committee which works hard to get original work and diligently keeps the presentations non-commercial. We offer all papers online in our Knowledge Base which is free to members. If you have a question, within a couple of clicks of a mouse the data base will bring up every paper on that topic which has ever been presented at a SMTA event. That's really valuable.

Beyond that I think what makes this conference unique is the people. For example, last night we had a retirement celebration for our dear friend, JoAnn Stromberg.

***Goldman:** She pretty much ran the association?*

Barthel: She wasn't there from the very beginning but she was there early on. She was with the association for 29 years. She really helped build the character of the association. You can go to other technical conferences, and they'll have an exhibition, papers, etc., but when you come to SMTA events you get an added family feel. We really strive to be inclusive, and the local chapters are where it's really apparent.

Certainly if you were at JoAnn's retirement celebration last night you saw how much she is appreciated from a global standpoint. Not only has JoAnne given time and effort to "the SMTA family," but there are many, many here and throughout the Association who know she embodies the open and inclusive culture of our organization. How many people do you know have over 200 people show up for a retirement celebration? She is a special women who has gained many friends along the way, and she runs a tight ship!

***Goldman:** How many active chapters do you have?*

Barthel: More than 50 around the world. I mentioned the student chapters and how there's really great growth there lately. We have a real

push. We recognize that the population, not just in the U.S. but around the world, is aging rapidly and the opportunities for young people go well beyond this industry. We really have a strong focus on students and bringing in new young professionals. For instance, this evening there is a bowling outing for young professionals. They can network in different ways, but we know, and they soon realize, that the Association has a lot to offer them.

Goldman: *They're networking with the companies and of course those are prospective employers when they're out of school.*

Barthel: Even if they just want to know what the industry is about or what the opportunities are, we connect them with that knowledge. Another element of our membership that we're proud of is our international growth. Anyone who has been in electronics knows much of the electronics that used to be in the U.S. has now moved to other regions.

SMTA has grown with this trend and we have some wonderful programs in Malaysia, Hong Kong, Mexico, etc. We more recently begun to expand our chapters in India and Brazil and we're following the industry throughout the world. For people in regions that don't have or experience or education in electronics assembly, the SMTA offers a great tool set. I personally was involved with the Penang, Malaysia start up. It's really universal, once you sit down with people and say, "Hey, this isn't about competition, its about education and improvement." People are willing to talk about common problems and not get commercial.

Goldman: *It's about knowledge and learning.*

Barthel: And it's universally accepted. It's wonderful to see other cultures, who may have different ways of doing things, value being able to collaborate and network. That has really propelled the Association.

Goldman: *SMTA is not involved in standards, right?*

Barthel: That's correct. The industry needs a forward looking body to drive new technologies and enable industry to adopt them. But standards are what allow us to all work together. That's what we worked diligently several years ago to develop the co-location of IPC at SMTA International. I worked with John Mitchell, the President of IPC to co-locate SMTA International and the IPC Fall Committee Meetings. SMTA brings the technical side of what's coming next, and how we're going to solve all these new problems, and they also bring all the practical solutions with the exhibition. The IPC standards effort fits right in with that. We're really glad and working to further integrate with IPC efforts at this event. There's no intent in our charter to be a standards organization. We're a knowledge-based and education focused organization. I think that fits really well with the good work IPC does on standards.

Goldman: *Now that JoAnn has retired, I understand someone has taken her place as executive administrator.*

Barthel: Let me explain that. The leaders of the Association are duly elected people from our membership. We have an election every year and Directors on our Board commit to this as an unpaid, volunteer position. Board members are passionate about our mission and bring a wide variety of perspectives and skills to bear on our direction as an Association.

It's been a blast. When we get together, everybody has the same enthusiasm for the net-

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JoAnn Stromberg enjoys her retirement party.

work and the association as a whole. We contract to JoAnn's company to provide all the hard services that our volunteers don't have the time to do. We've benefited from this structure; for 29 years JoAnn has staffed and managed all those important things to pull this off.

The Board of Directors gives direction for the Association and they carry out all the execution. This is somewhat of an understatement because JoAnn and team do so much to make everything work just right and ensure our members get the most out of the organization as possible. That business now will be run by Tanya Martin. We're very happy to have Tanya, whom JoAnn handpicked and has been working with for 18 months now. Most companies don't have that kind of transition, so we've been very fortunate to have the foresight of a good Board, and of course JoAnn's continued commitment to hand this organization off in a far better condition than she found it some 29 years ago. She certainly has done that. I met with JoAnn yesterday before the big event, and she's going out on top. Our membership has been growing year over year. Everything at SMTA is on the upswing, and we're so glad she's going out on this grand slam.

***Goldman:** May it continue. What can Tanya expect as she comes in?*

Barthel: Tanya is inheriting a well-oiled machine and we have utmost confidence in her. The Board has reviewed her background and capabilities and what she's able to bring to the Association. It will be different. We look forward to that because as we heard last night at JoAnn's recognition dinner that with change comes opportunity. We're looking for these new opportunities to be a little different in the way we work, but definitely there are things that aren't going to change. The networking, the openness, and the camaraderie that you get with SMTA will remain. I've participated in other associations, but you will not find this level of esprit de corps anywhere else in our industry. We're really proud of that and we welcome anybody who is going to read this to reach out and join us. They'll get all they need to know about joining on our website www.smta.org.

***Goldman:** Now I know this is an organization for EMS companies, but not solely. How broad is your membership?*

Barthel: Excellent that you bring that up. First of all, we want to be very clear that it's not only an EMS association. Members are SMT suppliers, consultants, research institutes, higher education, manufacturing, and users of SMT like OEMs, etc. We make a conscious effort that the Board of Directors is made up of a mix of Suppliers, EMS, OEMs, and academic leaders.

***Goldman:** Does one have an individual membership or company membership, or both?*

Barthel: Our foundation has been and still is individual memberships. The vast majority of our association members are individuals, but there are many companies that recognize and ask, "Why should I pay for just one person? Can I get Corporate Membership so that everybody at this location will benefit from membership in SMTA?"

There's an initial membership level that we came up with several years ago called a Global Membership, or global corporate. A company like mine, Plexus, has sites around the world. We take advantage of SMTA offerings all around the world at Plexus with the global membership, which allows everyone in my enterprise to get SMTA services and events at a discount.

***Goldman:** I suppose you have a student membership also?*

Barthel: Yes, that goes right in line with our growth in the student area. There are four levels of membership: student; individual membership, which is very common for one person; corporate, which is for one address; and global corporate, which is for everyone.

SMTA awarded JoAnn Stromberg with a unique framed print for her amazing career.

Goldman: ***What are the price points, starting with the student?***

Barthel: The student membership is $20 a year.

Goldman: ***That certainly is encouraging to them.***

Barthel: We just want them to know about the association. We're not charging the $5 to make money; we're charging this amount so they recognize that they belong to something.

Individual membership is $75. Members get access to the database we talked about, which is worth thousands of dollars if the were to purchase these papers on their own. The Corporate Membership gives you one location for $450. Everybody at that address may participate in events like this at a pretty steep discount, purchase books, etc. The Association knows people have travel restrictions or time restrictions so we're offering education through the web. We have strong webinars and web tutorials online on a regular basis. People can just sign up and participate. A lot of the names people recognize, people who are real experts in the industry are doing this at the comfort and convenience of their own desk.

Of course the Global Membership comes with several individual memberships—11 member log-ins, actually, but then you can add as many people through individual memberships as you like at a further discount. Each member gets their own log-in account that gives them full access the database.

Goldman: ***The corporate is $450 with one member log in, which is not quite the same. Then it costs $50 dollars for each additional member in that corporation?***

Barthel: The Corporate Membership applies to everyone at that location. Take for example an employee working on a surface mount line in the factory. They might not be an engineer who is going to want to do research and use the Knowledge Base log-in, but with a Corporate Membership they can to come to an event and get the 15% discount, which can pay for itself at one event.

Goldman: ***Is there anything else you would like to add?***

Barthel: No, except that I'm glad you gave me this opportunity to speak with you today.

Goldman: ***Networking is not just for finding jobs. It's for being able to communicate with others, learn and spread the knowledge, too.***

Barthel: Not only that, but in this age of Google, I often think to myself how some people don't ask questions anymore. Why have a dialogue with somebody when I can just search the internet for an answer?

With SMTA, I have access to face-to-face networking opportunities which also offers a camaraderie—and I really want to stress this. There's a real fraternal part of the Association that we appreciate and promote. You're here, Patty, and I hope you feel it with the other members you meet, which is something you don't get everywhere. That comes with people who sincerely enjoy helping others so you can trust them or recognize where they're coming from.

Goldman: ***Thank you so much.***

Barthel: Thanks for your time. **SMT**

A CLOSER LOOK AT SMTA

Tanya Martin, director of operations at SMTA, responded to our I-Connect007 questionnaire recently, which focused on the association's mission, membership statistics, and how SMTA best serves its members.

Tanya Martin

Q: What is SMTA's basic mission?

A: Our mission is to build skills, share practical experience and develop solutions in electronic assembly technologies, including microsystems, emerging technologies, and related business operations.

Q: How do you best serve your membership?

A: By delivering the strongest technical research at the local and national levels to assist them in improving processes and product development. In addition, the SMTA enthusiastically connects our members to local, national and international networks of people who are ready to offer assistance and fellowship.

Q: How much does membership cost? Please explain how membership is worth the cost.

A: Membership categories range from $5 to $75 for an individual and from $450 to $1450 for a business or corporation. Membership includes access to thousands of downloadable technical articles from our Journal of SMT and conference proceedings; the value is quickly recovered by providing the answers that can save members thousands of dollars in research and poor process control. It also allows access to a network of professionals that an individual may never acquire in a lifetime.

Q: What resources are most important to SMTA members?

A: Many members enjoy the support of a local chapter and local educational events. Our knowledge base of thousands of technical papers is probably the biggest resource as well as discounted rates on high-quality technical conferences and symposiums. We also offer online training modules and a full SMT process certifi-

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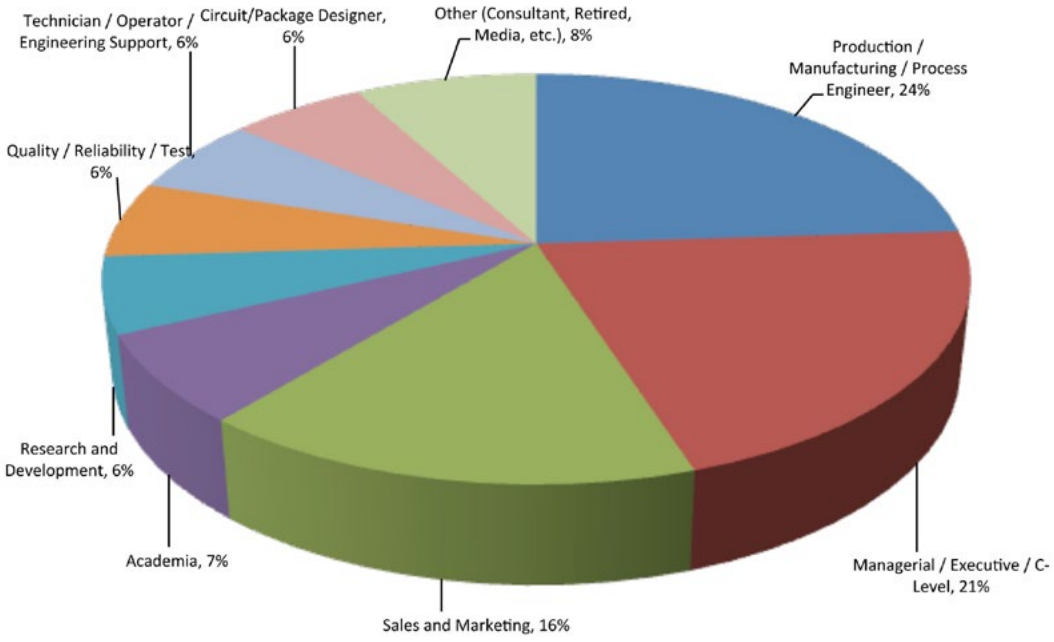
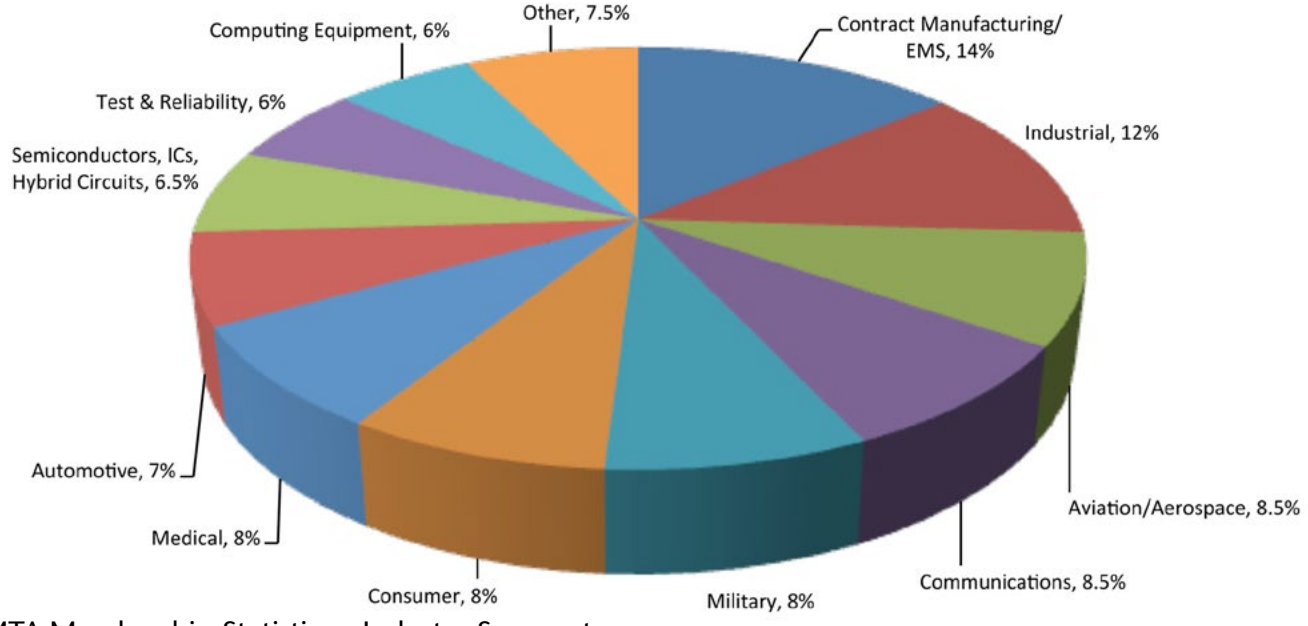
cation program. Intangible benefits that SMTA helps to facilitate are the opportunities to step into various leadership roles through committee assistance or on a chapter leadership team. This type of experience can demonstrate to an employer the motivation and ability to lead and take initiative as well as augment a resume.

Q: How do you satisfy members' need for technical information, and in what format?

A: Our technical committee is hard at work all year long sourcing the latest research and new technology that are most critical to our members' job requirements and business



SMTA Membership Statistics—by Job Description.



SMTA Membership Statistics—Industry Segments.

needs. We pride ourselves on delivering a vast amount of non-commercial content that is new and not previously presented elsewhere. This is distributed via workshops, digital articles, regional technical forums, national and international conferences and symposiums. Other vehicles for education are our SMT Process Certification program, local Chapter Tutorial Programs, and multiple types of online educational offerings.

Q: What are some of SMTA's success stories in the industry?

A: Several presidents, senior engineers, and managers at major OEM, EMS, and supplier corporations have credited their success to their direct involvement with the SMTA. Here is a link to a video that shows more.

Members often share attributions of career advancement, attributions of company growth, and lifelong friendships due to the SMTA network.

Q: What technologies do you consider the most important for the future?

A: Our technical committees are comprised of some of the best experts in the industry. They continue to be involved in research, new advancements/trends and surround themselves with a strong network of other professionals.

SMTA 2016 Events—Tradeshows*

Rocky Mountain Expo & Tech Forum	January 26
Houston Expo & Tech Forum	March 1
Dallas Expo & Tech Forum	March 3
Intermountain Boise Expo & Tech Forum	April 7
Atlanta 20th Annual Expo	April 20
International Conference on Soldering & Reliability Expo	May 10-11
Michigan Expo & Tech Forum	May 19
Carolinas Expo & Tech Forum	May 24
Upper Midwest Expo & Tech Forum	June 30
Ohio Expo & Tech Forum	August 4
Capital Expo & Tech Forum	August 30
SMTA International Exhibition	September 27-28
IWLPC Exhibition	October 18-19
Other show locations may include: Space Coast (FL), Austin, Philadelphia, Empire (NY), Connecticut, Boston, Oregon, Puget Sound, Wisconsin, Long Island, and Guadalajara	

** As of November 9, 2015*

SMTA 2016 Events—Conferences*

Pan Pacific Microelectronics Symposium	January 25-28
South East Asia Technical Training Conference on Electronics Assembly Technologies	April 12-14
International Conference on Soldering & Reliability	May 9-11
Symposium on Counterfeit Parts and Materials	June 28-30
SMTA International	September 25-29
IWLPC- Wafer-Level Packaging Conference	October 18-20
High Reliability Cleaning and Coating Conference	November
Other conferences may include: Medical Electronics, Automotive Workshop, LED - Assembly, Reliability, Testing, and more.	

** As of November 9, 2015*

A CLOSER LOOK AT SMTA

SMTA 2016 Webinars & Online Education Topics

- Alternate alloys
- BGA reballing
- Counterfeit materials
- Design for cleaning & reliability
- Design for manufacturing excellence
- Electro migration
- Failure analysis
- LED assembly
- Material properties and their effect on electronics devices
- Medical device reliability
- PCB fabrication and methodologies
- PCB failures
- Process optimization and defect elimination for PCBA
- Reballing of devices
- Robotic iron and laser soldering
- Root cause analysis & prevention
- Solder joint voids
- Stencil printing

We offer many channels to spotlight evolving technologies. Most recently, during our Evolving Technologies Summit at SMTA International conference, there were sessions focused on 3D packaging technology, 3D printing, low-temperature alloys, optics and photonics, wearable electronics, and embedded technologies.

Q: What types of committees/teams are currently active?

A: Our technical committee is split into many sub-committees to focus on each area of technology that is important to the success of our members, including: soldering, reliability, advanced packaging, cleaning and coating, mitigating counterfeit parts and materials, medical device needs, harsh environment applications, lead-free soldering technology, inspection technology, evolving technologies like wearables, and substrates and PCB technology. We also have active committees dedicated to developing low-cost and basic-level training, certifying engineers in the electronics assembly processes, membership, chapter leadership, exhibition and tradeshows, students and young professionals, marketing and communications, and more.

Q: How does SMTA cooperate with other associations?

A: Our focus is solely to serve the people within the electronics industry. We are open and enjoy partnering with other associations and already do so with several educational events throughout the year. If there is an occasion where we can combine strengths with another organization that would benefit the industry, the SMTA is excited to be a part of it. We currently offer a cleaning and coating conference with IPC, a counterfeit parts and LED symposium with CALCE/University of Maryland, a medical symposium with MEPTEC and iNEMI, and, of course, SMTA International is co-located with IPC's Fall Standards Development Committee meetings. We recently partnered with iNEMI to host an automotive workshop in Dresden, Germany, and with HDPug to deliver a webinar from leading experts on the tin whiskers defect.

Q: What upcoming standard/certifications do you feel people should be aware of?

A: Our association is not focused on standards. Much of the research and experiences we share help to either create or update the workmanship standards. We help the industry stay educated on the technology of electronics assembly from the leading edge to fundamental good practices as offered in our training program and epitomized in our certification program.

Manufacturing companies should be aware that they can add value to their business by ensuring their manufacturing and process engineers are SMTA certified for SMT assembly processes. Ours is the only program that recognizes and certifies the entire SMT assembly process at an engineering level.

Q: How does SMTA assist members in dealing with government agencies?

A: SMTA is not focused on lobbying. Certainly there are numerous other associations that can aid in this area. We are committed to provide education to assist in building skills, sharing practical experience and developing solutions. At some of our conferences, such as the Symposium on Counterfeit Parts and Materials, we address issues raised by governmental restrictions. Our topics attract specialists from governmen-

tal agencies, programs, and contractors to share with and learn to better understand industry needs and to assist in conforming to the necessary policies.

Q: What are SMTA's most successful programs and why?

A: Our local chapters are very successful as they get to the grass roots of people in the industry. They are hosting events addressing technical issues that speak to their specific region and helping real people solve real problems. SMTA International is our flagship technical conference as it successfully accomplishes our mission of sharing the knowledge on the largest scale.

Q: Why should someone join SMTA?

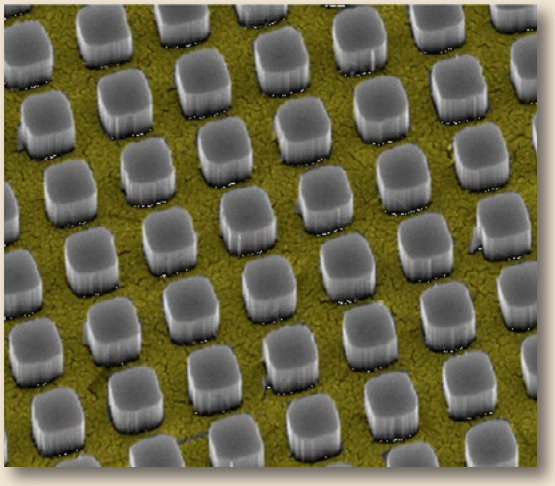
A: Membership in the SMTA delivers a competitive advantage to individuals and companies by allowing them to tap into a network of some of the brightest minds in the industry, enhancing your reputation as someone who is involved and aware of emerging trends and learning innovative manufacturing practices. You'll be part of a welcoming and inclusive association sharing original, high quality, and ground breaking work with people around the world. **SMT**

Stanford Technology Makes Metal Wires on Solar Cells Nearly Invisible to Light

A solar cell's widely used design has a flaw: the shiny metal on top of the cell actually reflects sunlight away from the semiconductor where electricity is produced, reducing the cell's efficiency.

Now, Stanford University scientists have discovered how to hide the reflective upper contact and funnel light directly to the semiconductor below. Their findings could lead to a new paradigm in the design and fabrication of solar cells.

"Using nanotechnology, we have developed a novel way to make the upper metal contact nearly invisible to incoming light," said study lead author Vijay Narasimhan, who conducted the work as a graduate student at Stanford. "Our new technique could significantly improve the efficiency and thereby lower the cost of solar cells."



In most solar cells, the upper contact consists of a metal wire grid that carries electricity to or from the device. But these wires also prevent sunlight from reaching the semiconductor.

"The more metal you have on the surface, the more light you block," said study co-author Yi Cui, an associate professor of materials science and engineering. "That light is then lost and cannot be converted to electricity."

Metal contacts, therefore, "face a seemingly irreconcilable tradeoff between electrical conductivity and optical transparency," Narasimhan added. "But the nanostructure we created eliminates that tradeoff."

For the study, the Stanford team placed a 16-nanometer-thick film of gold on a flat sheet of silicon. The gold film was riddled with an array of nanosized square holes, but to the eye, the surface looked like a shiny, gold mirror.

Optical analysis revealed that the perforated gold film covered 65 percent of the silicon surface and reflected, on average, 50 percent of the incoming light. The scientists reasoned that if they could somehow hide the reflective gold film, more light would reach the silicon semiconductor below.

2015's Most Read INTERVIEWS

ORIGINAL CONTENT!

Zentech's John Vaughan on the Mil/Aero Sector: "It's Headed Up"

I-Connect007 Publisher Barry Matties and Zentech's John Vaughan had a chance to discuss industry concerns within the mil/aero segment at IPC APEX EXPO 2015. The two also shared thoughts on the space industry.

Ready to Hire! Blackfox Provides IPC Class 3 Training to Veterans

Read this interview with Al Dill, president and CEO of Blackfox Training Institute, for an in-depth discussion on Blackfox's expansion plans for North America and Malaysia. Dill also describes the highly successful veteran's training program in Longmont, Colorado.

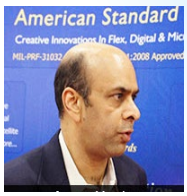
California Congressman Mike Honda Discusses American Manufacturing

Barry Matties, Publisher of I-Connect007, sat down with Congressman Honda, who represents District 17 in the Silicon Valley, and talked with him about American manufacturing, infrastructure, education and some of the current thinking in America.

A Conversation (and Day) with Joe Fjelstad

Industry veteran Joe Fjelstad, CEO and founder of Verdant Electronics, met up with Barry Matties recently to spend a day together enjoying their conversation that ebbed and flowed between a wide variety of topics including the "war against failure."

American Standard Circuits' Unique Offerings Contribute to Long-term Success



At the recent IMS RF and microwave show in Arizona, Anaya Vardya, CEO of American Standard Circuits discussed the current market trends, the company's recent equipment investments, and where ASC's growth will likely come from.

BGA or CGA: When Is It Right for You?

This interview with TopLine president and founder Martin Hart focuses on column grid array (CGA) and how CGA can solve delamination problems. CGAs, also known as CCGA, are not necessarily new but are making a strong comeback in the high reliability market.

A Look at the High-Reliability Interconnect Market

In an interview with I-Connect007, Mark Cormier of Miraco Inc. discusses his company's activities and capabilities, the latest trends and drivers in the high-reliability segment, and their strategies when it comes to managing their assembly work as well as their audit processes to find EMS providers.

Solder Jet Printing: Is It the Right Time?

Publisher Barry Matties gets an update from Nico Coenen, sales director for Mycronic, on their solder jet printing system. Mycronic has been developing and pioneering this technology for 10 years and they believe now is the time for it to gain real traction.

A Look at Saki's Approach to 2D, 3D and X-ray Technology

At NEPCON 2015 we sat down with Nori Koike, COO of Saki of Japan, to discuss the latest demands for 3D and their approach to inspection. Saki has built a line-up of tools that covers the inspection spectrum.

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IPC: CONNECTING ELECTRONIC INDUSTRIES

by Stephen Las Marias
I-CONNECT007

IPC President and CEO John Mitchell provides the basic overview of IPC—Association Connecting Electronics Industries, its goals and basic mission, activities, and how it best serves its membership. Also included is a snapshot of how IPC promotes technology development in the industry through standardization.

Q: What is IPC's basic mission?

A: IPC is a global, member-driven organization. As such, our mission is simple: serve the electronics industry. Whatever our members need to be competitive and successful in the marketplace, we deliver upon that need. This includes providing our members with standards, training and certification, market research, education, public policy advocacy and solutions to industry issues. IPC programs and services are dedicated to furthering the competitive excellence and financial success or our members through increasing end-product quality and reliability, improving communication externally and internally, and managing and reducing cost.

Q: Please summarize your membership stats.

A: We currently have more than 3,700 member companies, and operate offices and training centers across the globe. In order for us to serve our members, we need to be readily accessible and available. That is why IPC's offices span across China, India, Russia, Europe, and the United States. It is the best way to serve the entire electronics industry supply chain, which includes OEMs, EMS companies, suppliers, PCB manufacturers, government, and academia. And because the electronics industry is so diverse, our member companies are comprised of many different industry segments such as aerospace, defense, , medical, automotive, industrial, and telecommunications.

Q: What is IPC's approach to hosting events?

A: Being an association, hosting events is one of the ways we can effectively reach out to the industry. We are continually creating networking opportunities to bring industry professionals together whether it's through standards development activities or workshops, webinars, training sessions and conferences. Our largest annual event is IPC APEX EXPO, which will be

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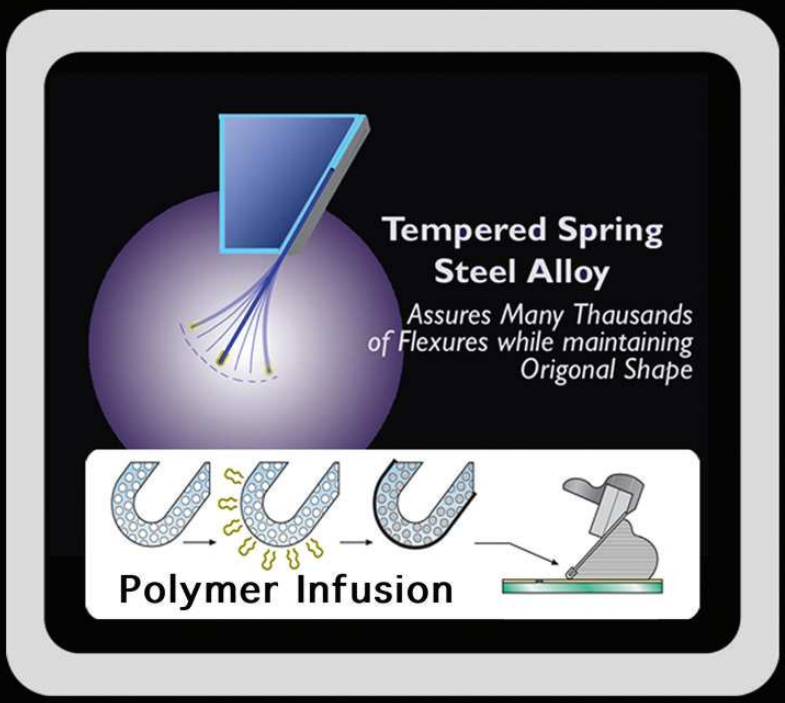

Technology for Improving SMT Print Quality and Production Yield

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IPC: CONNECTING ELECTRONICS INDUSTRIES

John Mitchell, IPC president and CEO.

held on March 13–17, 2016 in Las Vegas, Nevada IPC APEX EXPO is the industry's premier technical conference and the largest exhibition for the electronics manufacturing industry in North America.

On top of that, we provide regular technical webinars for products, standards, and regulatory issues. We host numerous educational events and offer technical training. This isn't just in the United States. IPC events are global, taking place across Europe and Asia. You can see all of our events at www.ipc.org/events.

Q: How do you best serve your membership?

A: As mentioned through our mission statement, our goal is to serve our membership by enhancing their financial success. We do this by focusing on offering the best standards, providing quality education, advocating for policy change, and creating solutions for industry problems. We work to unify the voice of the electronics industry, and oftentimes act as an advocate for change. Our standards committees are a great place where members can share their technical knowledge and help shape the future of the industry.

At IPC, we serve our membership in a number of different ways. Our key role is to facilitate exchange of dialogue and collaboration within the industry, and the typical vehicles we use include: committee meetings for standards development, technical conferences, trade shows, networking events, regulatory and legislative policy workshops and supply chain council gatherings.

Q: How much does membership cost and what is included for members?

A: We have a number of different membership packages, each created to fit the needs of individuals and organizations. Basic site membership costs $1,150, and IPC strives to put together competitive membership rates while providing maximum value and opportunity for all industry companies to join IPC.As the industry grows, many manufacturers or organizations will find that their needs have changed. IPC is prepared to meet the ongoing needs of our members through our membership packages.

With a growing portfolio of member benefits, IPC provides membership options that deliver savings on key products and services. This includes significant discounts on IPC standards, publications, and training materials. Members also receive discounts at all IPC events, including IPC APEX EXPO, as well as reduced registration rates on IPC conferences and other educational events. Being a member truly provides the materials, education, and means to succeed.

Q: Many I-Connect007 readers feel that standards should be free to members. What is your answer to that?

A: Today, IPC member companies receive a substantial discount on standards. If standards were free, membership fees would increase to represent the cost difference. In comparison, some associations provide standards to their members for free, but the association fee is significantly higher than other associations that charge their members a nominal fee for standards. With that being said, each IPC member site is offered one free download of a new standard, or revised standard within 90 days of the publication date. This is over and above the nominal discounted fee.

Q: What resources are most important to your members?

A: Our members are forward thinkers. They expect resources that will teach them current practices while preparing them for future needs. Our members depend and rely on standards, education, advocacy, and solutions. As such, they find value in our standards documents, certification and training materials, and GR advocacy efforts. We produce regular market research reports that highlight industry trends, and partner these reports with progressive educational opportunities. On top of that, our members enjoy learning breaking industry news through our newsletter, IPC Global Insight.

All of this culminates at IPC APEX EXPO. Our members understand the importance of the education and experience provided both on the show floor and in the technical conferences.

Q: How do you satisfy members' need for technical information, and in what format?

A: IPC members have many tools at their disposal to satisfy their need for technical information. Aside from standards, IPC training and certification is available to teach practical industry knowledge, as well as advanced topics. IPC also provides market research which analyzes industry data to provide accurate information on current trends and future needs. There are a number of webinars and newsletters which tackle a variety of issues. Beyond that, we also have TECHNET, a question and answer forum where members can ask IPC staff and their industry peers a technical question any day of the week, and get an answer 24/7. We strive to provide the best member experience, and providing technical information is one of the many ways we do so.

Q: What are some of IPC's success stories in the industry?

A: In recent years, IPC has had a number of big wins for the industry. To start, we keep current with all industry trends to update our standards to match pressing needs, including recent updates to several of our most popular standards J-STD-001F, Requirements for Soldered Electrical and

Electronic Assemblies and IPC-A-610F, Acceptability of Electronic Assemblies. Doing this requires a constant focus on industry requests, and an unbridled concentration on manufacturing demand.

For example, IPC was successful in our efforts to defeat the proposed restriction of additional substances under the RoHS revision in 2011. In 2012, IPC advocated for many provisions that were eventually included within the final SEC regulation on conflict minerals. Last year, IPC led industry efforts to pass the Revitalize American Manufacturing and Innovation (RAMI) Act— the legislation that established the National Network for Manufacturing Innovation (NNMI). Many of these efforts help reduce additional cost burden to the industry or provide opportunities for growth in advanced manufacturing.

Q: What technologies do you consider the most important for the future?

A: The industry continues to evolve. Each day brings new challenges and new solutions that push the boundaries of current technologies. Specifically, the increased use of flexible printed board technology has been a hot topic of interest. Additionally, incorporating lead-free assembly processing into aerospace and defense segments of the industry has been an ongoing issue that IPC is working on with its PERM Council to solve the technology issues. But, as these topics become more prevalent, IPC will work to identify emerging technologies that will impact the industry and bring the latest technology experts into our events and educational programs.

IPC: CONNECTING ELECTRONICS INDUSTRIES

Q: What types of committees/teams are currently active?

A: We currently have more than 300 active standard committees. All committee participants have the same goal in mind: to better the industry by developing industry driven standards. With that said, we assemble these committees to uncover issues that are at the forefront of industry. Our committees operate on a global level, and we encourage participation from every corner of the earth.

Q: How does IPC cooperate with other associations?

A: First and foremost, we look for a common ground. That's important. In order to benefit the industry, we look to collaborate with other forward thinkers. So when it comes to cooperation, we are always ready to find other likeminded associations who are concerned with addressing the needs of the electronics industry. Most notably, we have had a great, ongoing partnership with the World Electronic Circuits Council (WECC) that includes many of our "sister associations" including HKPCA, JPCA, CPCA, EIPC IPCA and more, and joined with Wire Harness Manufacturer's Association (WHMA) to produce the standard IPC/WHMA-A-620, Requirements and Acceptance for Cable and Wire Harness Assemblies.

IPC also collaborates with the electronics industries' foremost thought leaders and subject matter experts to create roadmaps, white papers and other documents. The biennial IPC International Technology Roadmap for Electronic Interconnections is a prime example of an international team of experts coming together to create an invaluable resource for the global electronics supply chain.

Q: What upcoming standard/certifications do you feel people should be aware of?

A: We have a lot on the horizon, including an update for IPC-A-600-J, Acceptability of Printed Boards. Revision J comes with much anticipation, as the last needed revision was revision H, which was launched in 2010. Since then, the industry has gone through some transformations and is ready for the next iteration. This revision will address a number of issues that will help usher printed boards into the next generation. Moreover, this revision is a critical companion to accompany IPC-6012D, Qualification and Performance Specification for Rigid Printed Boards, which is the definitive illustrated guide to printed board acceptability.

Beyond that, we are anticipating the release of IPC-6018C, High Frequency Board Performance Specification. We are also working diligently to create more online learning opportunities in 2016.

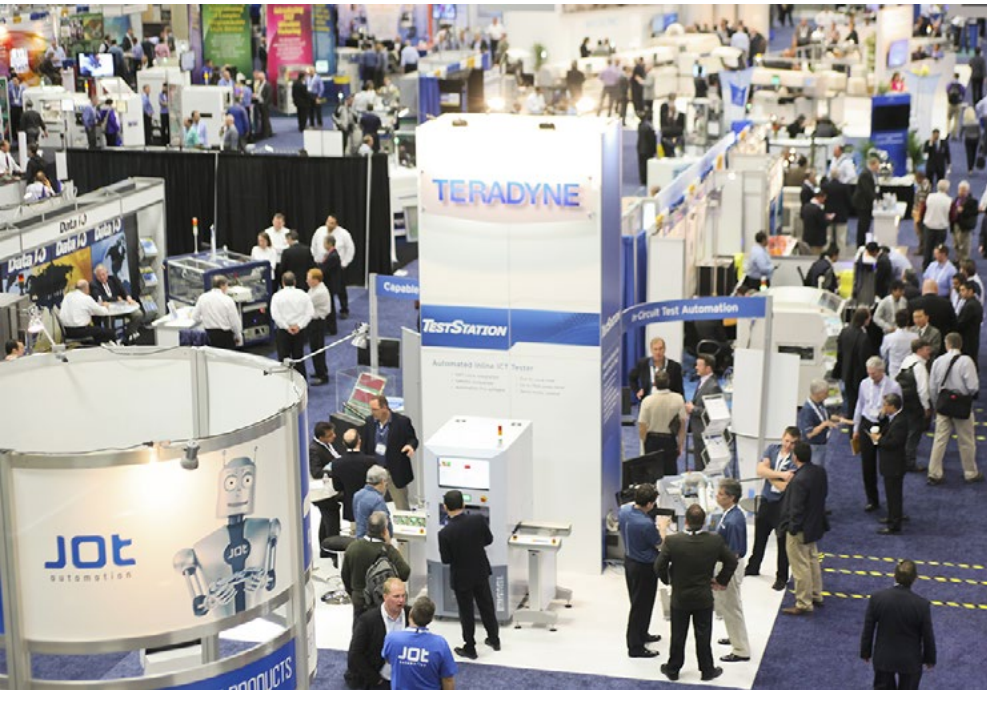
Q: How does IPC assist members in dealing with government agencies?

A: IPC is the leading global advocate for the electronics industry. Whether it's engaging with policy makers on Capitol Hill, in the European Union or China, IPC and its members proactively seek opportunities to educate, inform and influence policymakers on policies that spur innovation, growth and competition, and in the environmental arena, policies that are scientifically based and provide important protection.

Q: What are IPC's most successful programs and why?

A: Everything we do is created with a focus on the industry. Accepted worldwide as the key manufacturing standards for the printed board and electronics manufacturing industries, IPC standards are associated with nearly every stage of the electronic product development cycle. From design and purchasing to assembly and packaging, IPC standards help ensure superior quality, reliability, and consistency in the electronics assemblies that go into an electronic product.

Currently, IPC's collection of industry standards and guidelines exceed 300 active standards, and our resource library contains more than 1,000 standards. We have leveraged this knowledge to create programs to train and certify users across the globe. As a result, OEMs and EMS companies recognize the value of IPC credentials.



Q: Why should someone join IPC?

A: As a global, member-driven organization, we exist to help our member companies innovate, compete, and succeed. By being the hub of knowledge in the electronics industry, IPC provides standards, training and certification, market research, education, and public policy advocacy to help member companies achieve their goals. We are here to help our members create better quality products, enhance the skill and knowledge of their employees, reduce costs and waste, comply with regulations, and be ready to capitalize on what's next. **SMT**

IMAGE COURTESY OF GLOBAL SMT

SMART GROUP:
The Guiding Influence in the Electronics Industry

by Stephen Las Marias
I-CONNECT007

Founded in 1984, the SMART Group promotes advanced manufacturing technologies and helps companies cope with the challenges of surface mount technology. Its committees are made up of senior engineers from OEMs, contract electronics manufacturers, equipment makers, material suppliers and renowned consultants—providing a broad spectrum of knowledge and experience in the electronics manufacturing industry.

I spoke with Keith Bryant, chairman of SMART Group, about the association, its activities, and how it is supporting the electronics manufacturing and SMT industries.

***Stephen Las Marias:** Keith, could you please tell us about the main goals of SMART Group?*

Keith Bryant: The main goals of the SMART Group are predominantly education, advice and support.

***Las Marias:** How long ago did it start?*

Bryant: It started in 1984, during what I would call the advent of surface mount. There was a lot of history, a lot of knowledge, a lot of experience about through-hole—and almost zero of any of those things about surface mount technology. There were a lot of people looking for a lot of information, and effectively, the early days of SMART Group was almost like a support network where different people were trying to do different things, and they were all sharing the information of what was successful and what was not successful.

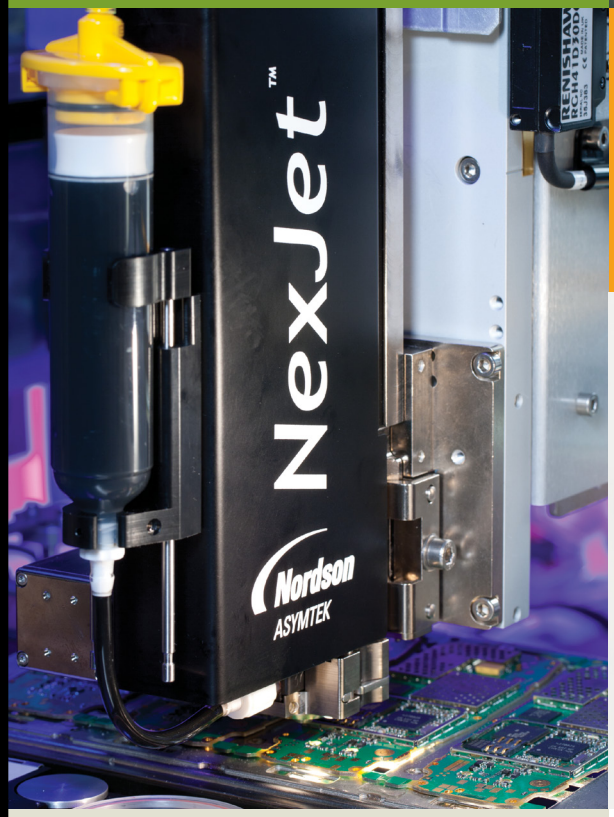
***Las Marias:** Is there a cost to the membership?*

Bryant: Yes, we have an individual membership and we have a corporate membership. We have to do that because we need to get funding to organize events and also to run our system, our website and all the other things.

***Las Marias:** Regarding events, what are some of the most successful events you've had so far?*

Bryant: The most recent large event was a two-day European conference, which we held at

Ready...



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the National Physical Laboratory in London. We had speakers from all over Europe and the United States. We covered everything—including the assembly of very small components, the 01005s and the 0300015, which are even smaller. In fact, the guys from Henkel had a technical paper that they did together with one of our consultants, Bob Willis, on how to assemble these things. At the other end, we had presentations on Industry 4.0. We had everything from the most technical details to the general business overview level.

***Las Marias:** Apart from seminars and workshops, what other means do you help customers from a technical standpoint?*

Bryant: In fact, you don't actually need to be a SMART Group member to benefit, but we have something called 'smart-e-link', which is a very large technical forum. There are more than 3,000 people linked to it and it's where any engineer can ask a question. Recent questions we've had have been about regulation, and the new laws for conflict materials and this kind of thing, throughpeople asking, 'This new component that I have doesn't solder.' Another guy who inquired had a problem with retouching solder resist because the resist is now a darker color than it used to be, and he got advised from five different people that there is a resist pen you can buy, but it's not normally available in the UK, but like all these wonderful things, you can buy it on the Internet. This guy was sent to the place to buy it from, with the part number and everything, and he posted a little note afterwards to say, 'Thank you very much, guys. This is great. It solves my problem completely. My customer is now happy again.'

Keith Bryant, chairman of SMART Group.

***Las Marias:** Speaking of technical groups, do you have those in place in SMART Group wherein you help in the creation or the direction of standards for the industry?*

Bryant: Not really as much as the guys like in the IPC. We're more concerned with what I call practical issues, rather than standards. We do work with the IPC and we've had them doing some presentations on some of the standards, but it's more of the implementation and the working to the standards rather than getting involved in committees that are trying to change things. To be honest, there are enough people busy doing that already. We tend to focus on what I would call the more hands-on approach. Most of our members are engineers or technologists and they're asking real-life problems about things like when the first QFNs appeared. They were and still are very challenging for everyone to assemble and there were lots of questions about that. We actually held a couple of seminars on assembling and testing those products.

Recently, another big thing has been cleaning in contamination because of dendrites and tin whiskers, so we've had a lot of focus on that, not only with seminars but also webinars, which we hold monthly.. These are great because we get people from all over the world signing up and paying to listen, and it's only two hours out of your day. You don't have to travel anywhere and there might be a group of ten engineers listening. It's a very successful way of getting information out into the world. And thankfully, because of the technical committee that we have, we have a lot of people who are giving up their time and their expertise to share it with others.

***Las Marias:** Why should companies in the industry join the SMART Group?*

Bryant: That's a great question. First of all, it will help them improve their products because the group has a wealth of information and experience to draw on. Surface mount has been around for a long time now. Some people are still just moving to lead-free because of the regulation and everything else. But when we started in 1985, no one knew anything; and now as we move further and further into lead-free, there're a lot of other companies with experience.

In fact, every presentation that has been given, either as a webinar or a workshop or part of a seminar, is actually stored in our database. If you have a problem with solderability, you can find different presentations from different people going back a long time, so there is a wealth of stored information available, in addition to access to webinars, seminars and the conferences, at a reduced price. We're only talking a few hundred pounds for a company to join.

***Las Marias:** Finally, Keith, can you talk about the outlook that you are seeing for the SMT industry?*

Bryant: Cleaning and coding is, and will continue to be a big issue. One of the guys who gave a presentation at our conference was talking about the very small components—the 01005s, the 0201s—and these components traditionally have an end-cap on them. So you have a solder joint that goes up the side, but they are now designing these components without end-caps—so the only joint is under the component. They're doing this because it's cheaper and it means they can pack the components closer and closer together. These components, if we talk about 01005, are 0.4 mm x 0.2 mm, and still they want to pack them closely together. But, of course, they then become very hard to assemble because coplanarity is a big issue. There's no nice fill-it joint at the end; the only joint is underneath.

I think these are going to become the next big challenge for our industry because Apple had already said that they really like this product and they're going to adopt it into their designs. A couple of companies who manufacture very small cameras and other small devices also like the idea of packing more and more components with smaller and smaller spaces, but no one talks to the poor guys who assemble.

That's one of the big jobs of the SMART Group, I think, for the next year at least; however, there will always be challenges. The legislation which is happening with WEEE and REACH all produce challenges in the materials that people can use, so when you change to a material, you effectively have to change or modify your process. So as the legislation carries on and the component design carries on, the challenges for people who assemble the product and test the product become more and more.

***Las Marias:** Thank you very much for your time, Keith.*

Bryant: Thank you, Stephen. **SMT**

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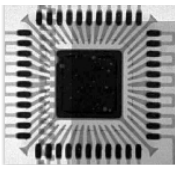
Solder Paste Stencil Design for Optimal QFN Yield and Reliability

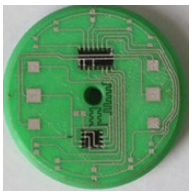


Over the past 15 years, the implementation of the QFN/BTC package has garnered a great amount of attention due to the assembly and inspection process challenges associated with the package. The difference in solder application parameters between the center pad and the perimeter pads is discussed.

A Review of the Opportunities and Processes for Printed Electronics

In the first part of this five-part article series, Happy Holden gives a brief background on printed electronics, as well as presents key technologies that are being employed for PE production.

Advanced Printing for Microelectronic Packaging



The concept of dispensing a wide range of materials in three dimensions presents a potential change in electronic packaging. This article covers the concept of combining dispensing technologies on a single platform to build integrated and monolithic electronic structural circuits.

Reliability Study of Bottom Terminated Components

This article series discusses bottom terminated components (BTC), and the stress and strain on these components when it comes to solder joints. In Part 1, the authors look at the impact of large voids at the thermal pads of BTC components and their impact on solder joint reliability.

How to Streamline PCB Thermal Design

Thermal issues with a PCB design are mostly determined during the component selection and layout phases. John Parry of Mentor Graphics discusses how addressing thermal issues early in PCB design, starting at the system or enclosure level, can help streamline the entire process.

Enhancing Thermal Performance in Embedded Computing for Ruggedized Military and Avionics Applications

Embedded computing systems used in many military and avionics applications are trending toward higher heat fluxes, and as a result performance is being hindered by thermal limitations. This article outlines a series of passive thermal improvements that are easily integrated into legacy systems and can provide a 3-4x increase in dissipated power.

Benefits of Soldering with Vacuum Profiles

Requirements for void-free solder joints are continuously increasing in the field of electronics manufacturing, bringing new challenges that are evolving on a daily basis due to the relentless introduction of new variants of so-called bottom-terminated components (BTCs).

NEPCON China Showcases Latest Manufacturing Tech in Asia

Considered Asia's biggest, most influential SMT and electronics manufacturing event, NEPCON China 2015 attracted over 450 leading brands from 22 countries, who showcased the latest electronics manufacturing technologies and products across an exhibition area of 25,000 sqm.

Pad Cratering Susceptibility Testing with Acoustic Emission

Pad cratering is difficult to detect by monitoring electric resistance since it initiates before an electrical failure occurs. This article presents the results of pad cratering susceptibility of laminates using the acoustic emission method under four-point bend and compares the AE results to the pad-solder level testing results.

EMI-caused EOS Sources in Automated Equipment

Electrical overstress causes damage to sensitive components, including latent damage. A significant source of EOS is high-frequency noise in automated manufacturing equipment. This article analyses sources of such noise, how it affects components and how to mitigate this problem.

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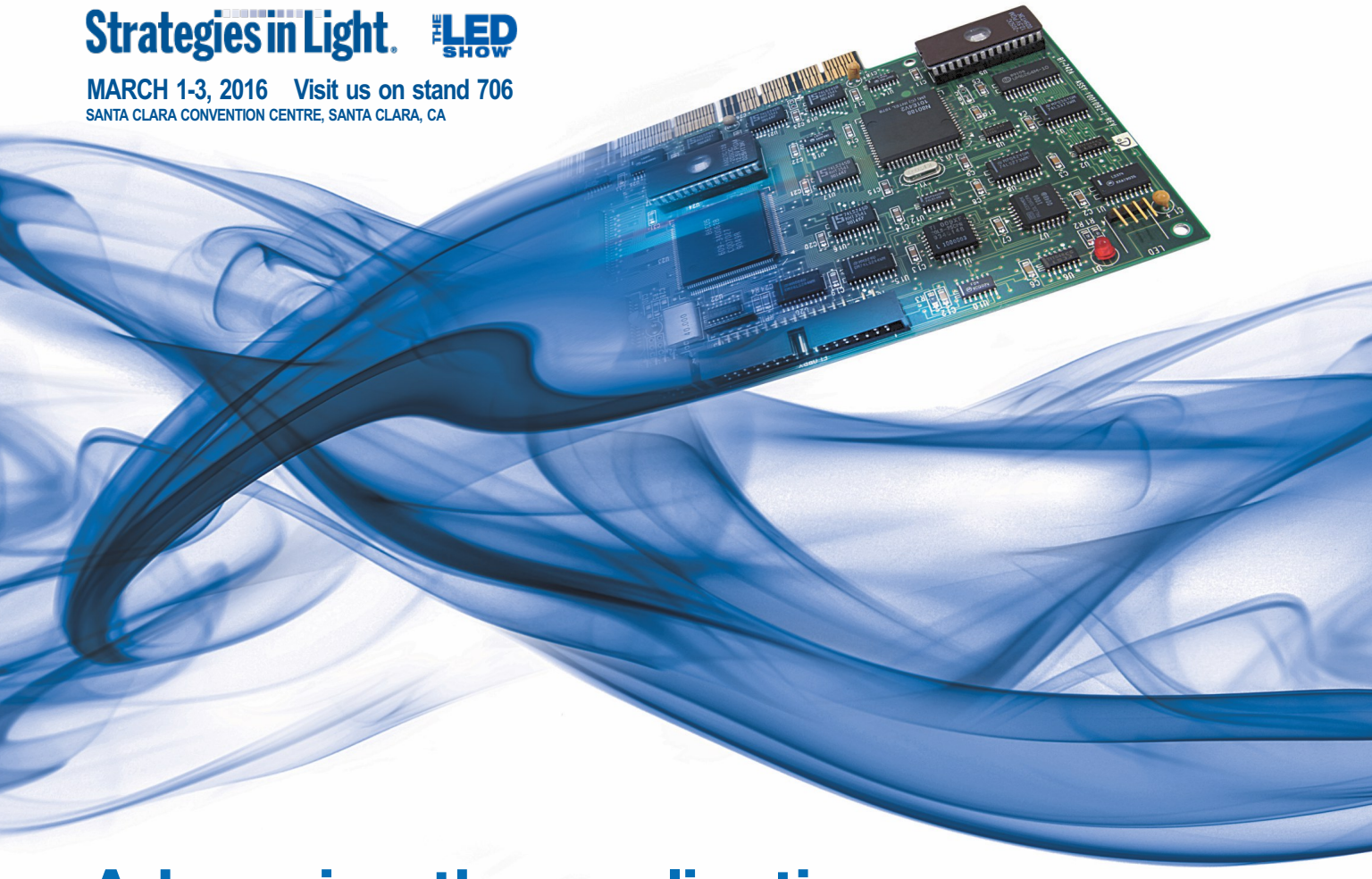

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OEM Applications: MacDermid's OEM Director Embraces Renewed Focus

by Patty Goldman
I-CONNECT007

At the recent SMTA International conference in Chicago, I sat down with Lenora Toscano, OEM director for the company's electronics solutions division, based in Waterbury, Connecticut. Our conversation covered MacDermid's dedication to fully understanding the needs of the end-user market of PCBs, her own role at the company, which involves much interaction with OEMs, and the benefits that both she and MacDermid bring to SMTA and IPC meetings.

Patty Goldman: *Lenora, tell me a little bit about your company and your role there.*

Lenora Toscano: Our electronics division supplies chemicals and chemical processes to PCB manufacturers. In an effort to expand our customer base using our knowledge from PCB manufacturing, we recently introduced a photovoltaics and an electronic packaging segment to our portfolio. This allows us to take the knowledge and expertise we have from 90 years in metal finishing and 50 years in electrical interconnect, then expand that knowledge base to emerging markets. Exposure into these new markets also allows for more innovation.

My role is to understand the needs of my customers' customers, the end-users. We sell to the PCB manufacturer and they then sell to an OEM in any type of industry—consumer electronics, automotive, infrastructure, etc.—and it's my responsibility to understand what these end use markets require in their PCB performance. If we have an understanding of what their end use needs are, and what their performance criteria is, we can ensure that the chemical processes we have at the manufacturer are appropriate for today's technology, as well as provide a pipeline of products for use in future designs.

Goldman: *How long have you been with MacDermid?*

Toscano: It was my first job out of college; I'm starting my 18th year.

Goldman: *That's impressive.*

Toscano: Yes, it was the right decision for me and it has been a great opportunity. I've been

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OEM APPLICATIONS: MACDERMID'S OEM DIRECTOR EMBRACES RENEWED FOCUS

Lenora Toscano, OEM director, electronics solutions division of MacDermid, Waterbury, Connecticut.

able to travel the world, meet interesting people, and learn so much. I really enjoy interfacing with the OEMs because I get to learn what type of technology is coming. Understanding their challenges as technology changes is very interesting. One of the things that has surprised me the most about my job is that as a chemical supplier we are the bottom of the industry, right? It's really the low man on the totem pole and I thought, "These OEMs aren't going to want to talk to me. They're not really going to have time to speak with the chemical supplier," but the reception has been overwhelming. They really do want to understand all the steps within the manufacture of their products; they want to understand the supply chain and how the chemicals work. The reception and collaboration has been exciting.

Goldman: ***And now with the OEMs you get a very broad picture and overview, which is excellent. Speaking of your customers, who are they? And do you see the OEMs as your final customers, or do you go beyond working with the OEMs and bring that information back?***

Toscano: Basically, I need to understand the entire supply chain. So I need to understand what the capabilities are at the fabrication level. I need to understand what's happening at the assembly level and then during final build for the OEM. Ultimately, I need to know what the final product will be exposed to, expected end use life, and performance requirements in end use. Really, I'm trying to make the electronics supply chain smaller and bridge communication at all levels.

Goldman: ***When that information you gather comes back, it then gets disseminated to the PCB companies?***

Toscano: Yes, it gets disseminated to the PCB companies that we work with, and it gets disseminated to our researchers, technical teams, and application specialists.

Goldman: ***It makes you quite forward thinking and creates a lot of opportunities for MacDermid, right?***

Toscano: Right, it allows us to be forward thinking. We know where our strong suits are now, and what's going to be growing in the future.

Goldman: ***You are also presenting a paper this week, correct?***

Toscano: I will be giving a paper as part of the substrate division on surface roughness. For surface finishing there are a lot of performance characteristics that we're looking for, specifically solderability. In certain instances, tarnish resistance, corrosion resistance, and for the lead-free alternatives, we find that the copper roughness is playing an important role in the end performance, specifically for thin-film deposits, such as immersion silver, immersion tin and OSP. If the copper coming into the final finish line is very rough or erratic, it can have an effect on its final performance. I'm trying to call

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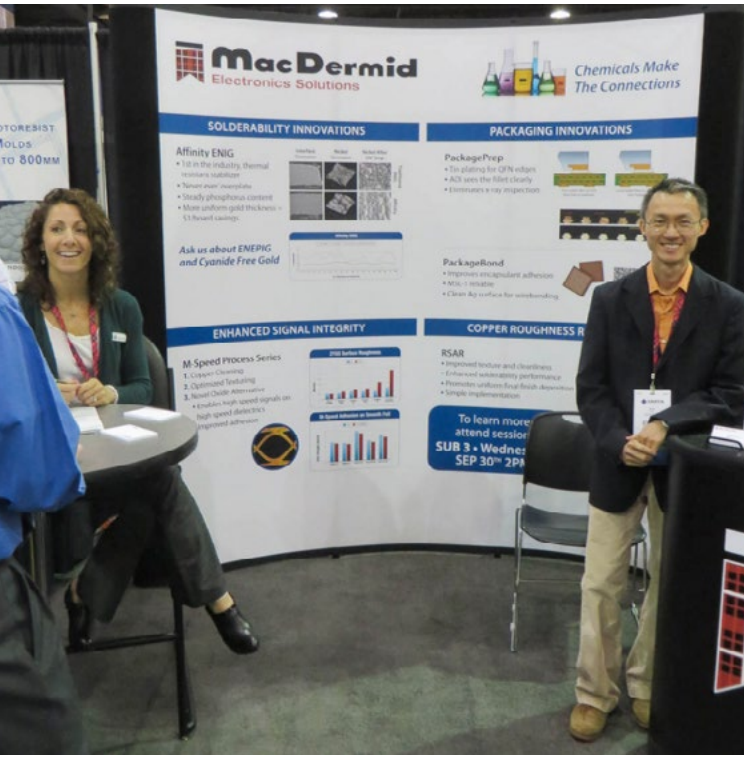
attention to the importance of surface roughness—that we're controlling surface roughness before we get into the final finish line and that it can dramatically improve the performance. It might not be a necessity for every single application, but for high-reliability for very intricate assemblies it's very important.

***Goldman:** Why did you choose SMTAI for your presentation?*

Toscano: The SMTA International conference is my favorite technical conference. It's an incredibly collaborative group of people. Someone mentioned this morning that they had been in an interesting situation the very first time they went to an SMTA meeting almost 30 years ago. There were two competitors at a table and one had a very strong technical issue and the other was sharing how they had solved it for themselves. For me, it always feels like as a group we're trying to find a resolution. We're not competing so much against each other in this environment. And you know, of course, there are going to be instances where you're protecting your intellectual property; you're not going to give up everything, but as an industry we will get to a better place. We will be more successful, faster, if we work collaboratively, and that's what's amazing about the SMTA. There are so many different individuals working together, from chemical suppliers, through fabricators and the OEMs.



There's just so much knowledge in one small area, and that is why I keep coming back to this conference. I believe my first conference was 1999, so I've been coming here for some time. This year I've been invited to be a part of the technical committee for SMTA International. I am honored to be asked to play a role in choosing the technical papers that would be part of this conference.

***Goldman:** Are you active in your local SMTA chapter?*

Toscano: Over the past few years, MacDermid has become a more active member in our local chapter. Jun Nable, our research project manager, is the president of the Connecticut chapter. He previously held the position of Secretary. Also, one of our newest researchers, Alex Konefal, is the VP of operations. We've been able to host a few technical talks at MacDermid, which has been nice and we have seen a good turnout, so we're going to continue to do that.

***Goldman:** You must have a great place for meetings.*

Toscano: We do; we have a good facility for it, and being centrally located in Connecticut allows for a number of companies in the surrounding area to come and contribute to the meetings.

We also have a booth here at SMTA this year. We have two posters from our R&D teams, which will be presented at the poster session and we're excited about that. We really want to get our technical staff exposed to international conferences as well as those on the local level. This not only gives us exposure but also showcases the innovation and hard work that we're doing.

***Goldman:** I'm guessing there are other MacDermid people involved in the IPC committees and subcommittees also?*

Toscano: Yes, we have a number of personnel who work on the IPC committees and subcommittees. Since SMTA and IPC have come together, it's been great; we can do everything under one roof now. There can be challenges when you have to be in two places at once, but with enough staff at the conference we manage to attend all meetings and sessions.

Goldman: *I agree, that's very true.*

Toscano: Committee standards are something that MacDermid has always been an integral part of. It's very important that we understand what's going on with them, for ourselves and for our customers, so we continue to play a role there. I am part of the 311G committee as well as the 414. So I look forward to seeing some updates with those groups this week.

Goldman: *Will you get a chance to go to the committee or subcommittee meetings?*

Toscano: I will.

Goldman: *On a more personal note, did you start out in the lab at MacDermid?*

Toscano: Yes, I started as a bench top chemist. I slowly worked my way up to project leader for our final finish team. Ultimately, I became the director of Final Finish. Because of that position I had a lot of interaction with OEMs, which led to becoming the director of OEM applications.

Goldman: *How long have you been in this position?*

Toscano: I've been in this role for three years.

Goldman: *Was it a new position, where MacDermid said, "OK, we need to pay more attention to these people," or was it an existing position?*

Toscano: We previously had the position for a very long time. We understand the value of it. But sometimes you slip away from things to focus on different areas, especially in research and development, so there was a period of time where it probably wasn't getting enough focus.

Goldman: *So the position kind of languished and then...*

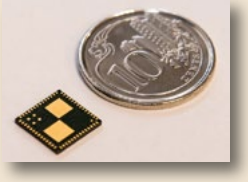
Toscano: And then came back to life. It became a more strategic focus for our division.

Goldman: *Yes, and you brought it back to life, which is excellent. Lenora, it's been really nice talking with you.*

Toscano: Thank you, Patty. **SMT**

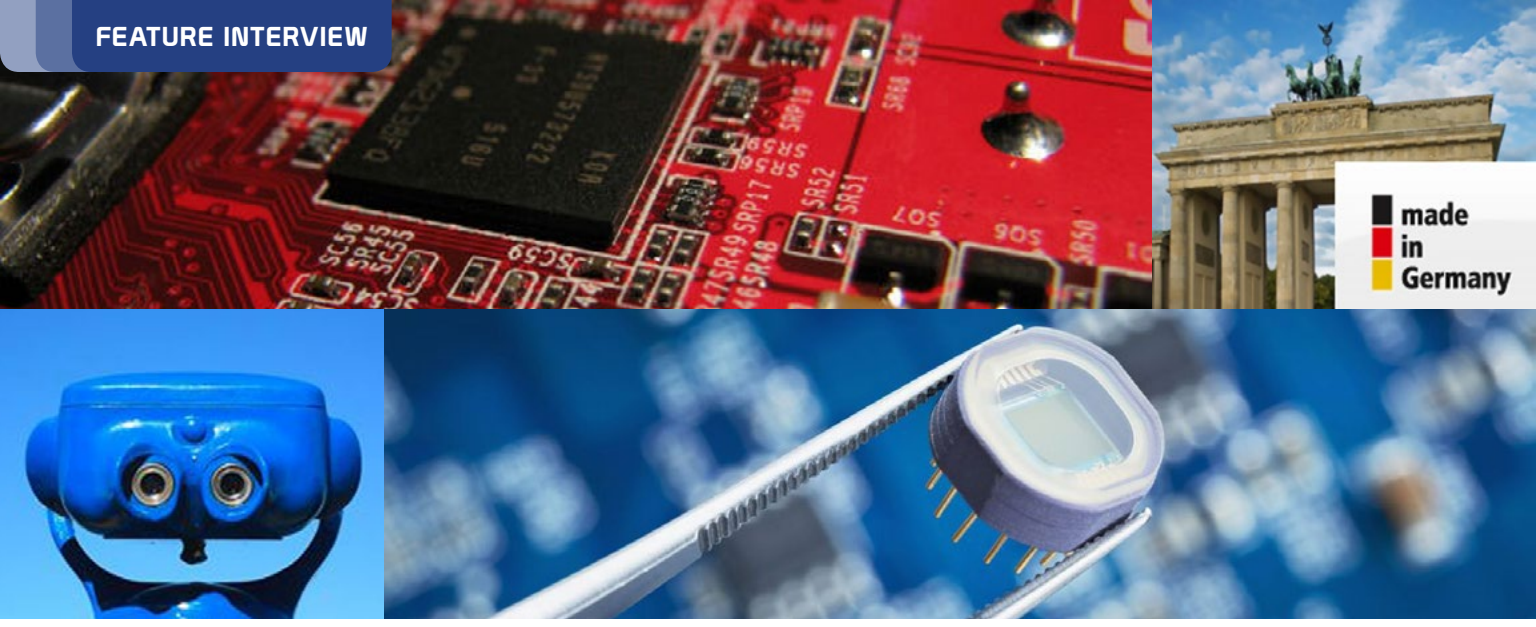
NTU Smart Chip Tells the Health of a Battery

Scientists from Nanyang Technological University (NTU Singapore) have developed a smart chip which can tell you how healthy is your battery and if it is safe for use. Developed by Professor Rachid Yazami of the Energy Research Institute @ NTU (ERI@N), this smart chip is small enough to be embedded in almost all batteries, from the small batteries in mobile devices to the huge power packs found in electric vehicles and advanced aeroplanes. Embedded in the smart chip is a proprietary algorithm developed by Prof. Yazami that is based on electrochemical thermodynamics measurements (ETM technology).



In addition to knowing the degradation of batteries, the technology can also tell the exact state of charge of the battery, and thus optimize the charging so the battery can be maintained in its best condition while being charged faster.

The smart chip is now marketed by Prof. Yazami's start-up, KVI Pte Ltd. Working with him at ERIAN is research scientist Sohaib El Outmani. It is expected that the technology will be made available for licensing by chipmakers and battery manufacturers before the end of 2016.



VDMA PRODUCTRONICS:

Pushing Forward the German Electronics Manufacturing Industry

by Stephen Las Marias
I-CONNECT007

Verband Deutscher Maschinen- und Anlagenbau/German Engneering Federation (VDMA) is one of the key association service providers in Europe, and offers the largest engineering industry network in the region. Founded in 1892, it represents today more than 3,100 companies in the engineering industry, many of which are small- and medium-sized enterprises.

VDMA Electronics, Micro and Nano Technologies is one of the 40 Sector Associations within VDMA. Its sector group Productronics, which covers the whole semiconductor front- and backend processes, packaging, all the way to PCB manufacturing and assembly, has about 70 member companies. I recently spoke with Dr. Eric Maiser, managing director of Productronics, about the group, its activities, member services, and the electronics manufacturing industry.

Stephen Las Marias: *Dr. Maiser, let's start by describing VDMA Productronic's basic mission and what your organization is all about.*

Dr. Eric Maiser: The basic mission of the association is of course to help the members. How do we do that? Basically through three pillars, if you will. Of course, industry associations are lobby groups, so we have discussions with the industry, find out their needs, and communicate that to politics and the public. This is what you expect from an association, and we do that. That's also related to research, politics, and those kinds of things. Where the other pillars come in, which is what the members pay us for, is with the services and networking capabilities we provide. We bring together machine makers along the whole process chain and that's a value to them. Understand that the German machine makers are usually small- to medium-sized enterprises. It's not companies such as Siemens and Bosche overall. They usually don't have big legal, foreign trade, or tax departments. This is a layer we provide. For VDMA Productronics, the specialty istechnology oriented. Our mission is to help them with finding the next trend in electronics manufacturing—so road mapping—and how to provide machines with the latest technology but at a reasonable cost.

Things known in the semiconductor industry, for example, are not very well known in the SMT sector. So we also do something like knowledge transfer. It's also bringing the machine makers together with their customers. We hold matchmaking events and those kinds of things. Our mission includes the services, networking, and of course, lobbying.

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***Las Marias:** Can you give us a snapshot of your membership statistics?*

Maiser: In VDMA as a whole, we have more than 3,000 members. That's throughout the whole machinery industry in Germany—ranging from wood machines to mining machines to robots. We have 40 of these sector associations within VDMA, and Productronics is just one of them. We have everything from the whole semiconductor front- and backend processes, packaging, and then going forward with the PCB side and the assembly side. It's really the whole process chain for electronics.

We do that because the German machine makers in that sector have a multitude of machines for this whole process chain. What also rises from this is the ability to really provide information on the technology developments happening in the semiconductor industry, which might be important for the SMT industry, and vice versa. As you know, these things merge. Previously, you had the chips and you had the PCB on the other side. You put the one on top of the other and that was it. Now, we have all these embedding of chips into the PCB or with the chips becoming smaller. We as VDMA Productronics have all the players along the process chain there, and it's a value for them to talk to each other.

It's a little bit unusual for VDMA because usually in federation, we have the sector associations along one machine type, like robots for example. It doesn't matter if the robot is working on a car or if it's working on, let's say, a plastic or rubber manufacturer. Here we have something like a cross section through machine types. We start with ingot manufacturing for silicon. This is basically heating, slicing the wafers, and then all the processes through soldering and everything you have in the process chain—all types of different machines. Of course, we have competitors there, but they don't cover all machinery types with a lot of different customer areas. That makes us a little different within VDMA, too.

***Las Marias:** At VDMA Productronic, do you have any events or conferences? Do you have webinars or technical sessions for your members?*

Dr. Eric Maiser, managing director of Productronics at VDMA Electronics.

Maiser: We have workshops on road mapping, on total cost of ownership, and on line integration, for example. Then we have two yearly events. The workshops are really focused on very specific topics, and the yearly events provide an overview for what's going on in the association and what's going on in the industry. Usually, we have one event at a member site or a customer site. It's boring if you go to Frankfurt and just see our offices. So we go outside and really see what the customers or the members are doing. The second event in the year is usually with institutes, research organizations, so that we can learn what the academia is really doing and what the next possibility for electronics coming along is.

Plus, of course, as a VDMA Productronics member, you have access to a whole lot of other VDMA workshops and events. There is so many more than I can tell you here, ranging from these exchanges of experiences for tax or for foreign trade or for legal stuff. We also have regional offices so you can even talk regionally—what's happening in Bavaria, for example, in terms of new regulations and all that. This is not Productronics specific, but a member of VDMA Productronics can access all this so you basically have a broad multitude of events that you can join and learn something from.

***Las Marias:** How do you satisfy your members' need for technical information?*

Maiser: In a number of ways. First, we do that by individual consultation. A member can call me and can ask for help in any way. I'm a physicist so part of the job description for me is to really find out the new technology hypes and be a translator, so to say, between research organizations and the small- and medium-sized enterprises. Bigger companies always have their own research organizations within the company, but even those guys usually don't dig very deep into the latest technology. You have to make them aware of things happening at university level or be the one really digging into things. This is actually my job. Individual consultation comes with that, but we also have events and the workshops. The road mapping workshop is exactly what you're asking about, where we sit together and really have a methodology on how to go through the next 30 years, for example. We discuss what's happening in the next 30 years in terms of electronics manufacturing or the equipment.

We also dig for new opportunities. In the last 15 years, I have built subsidiaries under Productronics. I went into displays, organic electronics, photovoltaics and battery. You also have soldering, you have something like the position technology—you have all the technologies that Productronics guys provide. Those were new opportunities to dive into and create new businesses. It was my job, so to say, to tell them, 'Look, there is a business opportunity for you in, let's say, photovoltaics, wafer slicing, wafer connection, wafer soldering, and so on.'

***Las Marias:** You mentioned part of your job is to find new technology hypes. Can you highlight some of the technologies that you consider the most important in the future?*

Maiser: Yeah, that's a tough one. It's easier probably when I start with the semiconductor side because it's public domain. Going into a bigger substrate is something you always have to do when you want to bring down prices and then raise efficiency. This is the same for semiconductor wafer sizes as well as PCB sizes. The hard one for the semiconductor side is that you go down to below 20 nm structures, feature sizes, and there you have this famous extreme UV switch. You have to go from ordinary light sources like laser light and you have to go down to X-ray. With that, you don't have the optics you usually use. You have to use mirrors and that causes trouble with the light sources. You also have a lot of trouble, of course, creating a vacuum and creating the precision in deposition. There are so many things, but that's all written down in the semiconductor road maps.

The trouble is not only technology wise. It's basically that there's only a very few customers that can go that road. For extreme UV, the whole story boils down to basically five customers worldwide. Of course, if all of the machine makers fight for these four or five customers, then the whole story becomes hard from that part alone. Even if you are able to do the technology part, it's not so easy to grab your customer.

It's a little bit different for the PCB and the electronics assembly side. I think the future there is also very closely connected to what's happening on the semiconductor side. Feature sizes going down always means that you have smaller feature sizes for the PCB. How to really get along with that is the name of the game. From the manufacturing side, this is basically it. We could dive deeper into the technology of the PCB and also the SMT manufacture, but what comes along next, then, is Industry 4.0. You have to produce all that stuff in a manner that

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people can buy it so that it's cheap enough. That means automation. But 100% automation is not always the thing you want to do, so adaptive automation is the thing you want to head for.

This is probably also one thing you will really address in Industry 4.0. You find ways to not only have this maximum self-organizing production as we called it a couple of years ago, where you don't see any humans in the fab. It really is about creating an environment where humans work together with machines in a way that's good for both sides. While you're easing the work of the humans, we also have this new topic of collaborative robots, where you have stupid monotonous work taken by the robot but collaborating with the human safely, so it's not really the scary machine but something like a colleague. We have a special here at the show about augmented reality, which is a very nice technology that came from the gaming industry. So technology advancement doesn't only come from the production technology or going down in feature sizes for PCB or semiconductors. It also arises from how to use the machines.

This also is very important for the members because that's another business opportunity. If you have this nice augmented reality in your machine and your customer likes it, he will probably buy the next machine from you rather than from your competitor because you have this nice feature. It's not the feature of production technology inside the machine. It's just the feature of how to use it.

***Las Marias:** What types of committees or teams are currently active in VDMA Productronic?*

Maiser: We very much rely on our members as steering committees. We have a board. In VDMA as for other associations, too, there are people who are paid, like me. Then there are the members and members vote for a board. The board is the steering committee. We have a steering committee that,as Productronics itself, really consists of known people and very good people from all parts of the process chain, so that we have a nice cross-section of the industry. Sometimes, when we have these new activities we create subgroups and then also subheads. As I said, for these new groups—displays, organic electronics, PV and battery, we created completely new groups. They are still attached to Productronics but they have their own boards. They have their own people who work on it. They are even sometimes bigger than Productronics. For example, Productronics has 75 members. The organic electronics subgroup, for example, has 250 members. The battery group has 100 members. Sometimes, we create so much new hype and new ecosystems, people say, 'Yeah, this is new. I have to go in there. This is interesting.' Things become very big then. We created organic electronics in 2004. It's still a new technology and still not in full production, but it's so attractive that people say, 'Yes, I have to be part of that.'

***Las Marias:** How do you cooperate with the other associations?*

Maiser: This is a must. You cannot do everything on your own. Of course, we are an association for the machinery industry only. We basically have only the machinery people with us. There are exceptions to the rule, of course, so for the organic electronics we really created a whole environment that the customers and the materials makers are in. For Productronics, it's pretty clear that if we want to talk to customers we also want to talk to the customer associations. In Germany, there is the ZVEI (Zentralverband Elektrotechnik- und Elektronikindustrie e.V./German Electrical and Electronic Manufacturers' Association) and we have also collaborations with the optics industry and with the German Chemical Industry (VCI). We also have within Germany collaborations with the

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engineering societies like Association of German Engineers).

I think for Productronics, it's pretty important to have international connections. There is a strong collaboration with SEMI. I'm even sitting on their board there. We've been collaborating with SEMI since the foundation of Productronics in 1983. It's fruitful because they come in as an international organization mostly focusing on semiconductors with a European branch. We come directly from the other side. We are a strong national industry association.

The collaboration with IPC or SMTA is not as close, but we also have connections there and conduct talks between both sides. On top of that, we also have collaborations with trade fair organizers and many research institutes. It's a whole ecosystem.

***Las Marias:** Can you tell us how you assist your members in dealing with government agencies?*

Maiser: That's one of our pillars. Usually that's also twofold, the government coming to us and asking what the needs of the industry are; and the other way around—members coming to us and saying, 'Look, government should do something. Help us.' We are the matchmaker between the two. There are certain rules you have to obey and not all the wishes of the members can be directly translated into government action. We are very active in the German ministries obviously. We also have a European office in Brussels. VDMA is a known organization there, so politicians often ask us when they want to know something about the industry. For Productronics, this is very important because we don't only have this background on the electronics manufacturing equipment, but also on the manufacturing equipment industry as a whole. We always can say, 'Okay, the benchmark for the machinery industry in Germany is this and that.' Electronics production equipment is no different than that. The export ratio is high throughout the whole industry—75% for the German machinery industry. Of course it's higher for the electronics production.

Workshop with machine makers and customers.

Then politicians understand that if they call for fabs in Europe, we say, 'Fabs in Europe are very important and of course it's very good to work together on the same continent. However, we have to be fit for export. We have to export. We can only sell 25% in Europe, so we have to go to Asia. We have to go to the U.S. We have to do business there. How can you help us with that?'

This is not always in people's minds or in the minds of the public. They believe a company producing in Germany is basically also selling in Germany. This is our job to tell them, 'Look, the outside world, global business, is a lot more important than local business.'

***Las Marias:** Dr. Maiser, can you highlight some of your most successful programs and why they are successful?*

Maiser: The most successful programs are probably those spin-offs because they came at exactly the right time. The very successful one is the photovoltaics part because German machine makers still have 50% of the world market for photovoltaics machines. Although there is, of course, always in people's minds, that the photovoltaics production in Germany went down by a lot, but we are very successful on the world market. For us, it's important that we sell machines regardless of where.

Right now a very hot topic in discussion with the politicians is battery manufacturing. This is very nice for us because there are lessons learned in other related industries like electronics, semiconductors and PV, that you can directly apply to battery production.

This makes it easy for us to tell people, 'Look, what we've done in the PV industry worked, so let's do that for battery.' People are

going forward with that. Also, discussions with politician, with members, and with the press are going very well right now.

***Las Marias:** Dr. Maiser, why should a company join your association?*

Maiser: Because we have the network. We bring the machine makers together along the process chain. We can help with discovering the next trend. We can help with all these business-related things like foreign trade or legal things or taxation. There is a whole buffet. You pay an entrance fee and you are free, really, to pick what you need.

***Las Marias:** How much does membership cost?*

Maiser: That is related to the turnover of a company. That's a rule. The rule is 0.08% of the machine-related turnover. The machine related turnover is usually the hard part because it's not the total turnover of the company, usually. This is something we always have to figure out. The nice thing about our membership fee is you have the one time entrance fee and then you can access the whole VDMA, not only our Productronics group. And the money we earn with the membership fees is breathing with the economy. If the economy is bad for the machine makers, we earn less money, which is okay. If it would be at the same level all the time, people would say, 'The economy is bad. Why do we have to pay so much?' Other than, for example, American associations where you basically have one basic membership fee and then you pay additional fees on top for every service you take, we really have this one entrance fee to cover it all.

***Las Marias:** Is it different for individual members or companies?*

Maiser: We only have company members, not individual members. This is exactly the differentiation we have from the engineering societies. In the engineering society, you become a personal member and pay a small fee for a single person. If from the same company another person wants to join, he has to pay, too. For us, you pay just one fee per company. There is no government money involved so this is totally private non-profit.

***Las Marias:** Dr. Maiser, thank you very much for your time.*

Maiser: It was a great opportunity. Thank you very much. **SMT**

Versatile Single-Chip Sensor for Ion Detection in Fluids

imec and Holst Centre have demonstrated a prototype of a single-chip electrochemical sensor for simultaneous detection of multiple ions in fluids—paving the way to small-sized and low-cost detection systems for agriculture, healthcare and lifestyle applications, food quality monitoring and water management.

The ion sensor solution is a generic platform that can be tailored towards specific applications. It enables efficient and low-cost monitoring, such as monitoring of nutrient concentrations in surface and waste water, both for agricultural applications and water quality. Depending on the application and the form factor, it can be mass produced through microfabrication or through screen-printing on inexpensive substrates such as glass or foil. As compared to commercial ion sensors, this brings a unique advantage in terms of low cost manufacturability, and size of the solution. Moreover, by changing the selective membranes on the electrodes, the sensor can be adopted to detect other ions.

The presented prototype is a handheld device that integrates a single-chip sensor with different electrodes that detect pH levels in a range from 2 to 10 at a 0.1pH accuracy. Benchmarked against other available single-ion sensors, imec's prototype demonstrated comparable sensitivity and accuracy for a versatile multiple-ion solution.

iNEMI: Leading the Way to Successful Electronics Manufacturing

by Stephen Las Marias
I-CONNECT007

Bill Bader, CEO of the International Electronics Manufacturing Initiative (iNEMI), talks about the consortium's goals and mission, its collaborative projects, as well as its roadmap for the electronics manufacturing industry. Bader also highlights iNEMI's milestones in line with the major trends that have happened in the electronics industry, including the transition to lead-free, addressing tin whisker growth, and the move towards HFR (halogenated flame retardant)-free PCB materials.

***Stephen Las Marias:** What is iNEMI's basic mission?*

Bill Bader: iNEMI is a non-profit consortium comprised of companies that represent all aspects of the electronics manufacturing supply chain, along with government agencies, university research centers and independent research institutes. Our mission is to forecast and accelerate improvements in the electronics manufacturing industry for a sustainable future.

***Las Marias:** What are your membership stats?*

Bader: iNEMI is a corporate membership organization. We have close to 100 members, including OEMs (13%), ODM/EMS firms (7%), material suppliers (37%), equipment providers (13%), research institutes (12%) and other consortia and associations (15%). A little more than half of our members are based in North America, with an additional 22% in Asia and 20% in Europe.

***Las Marias:** Does iNEMI host any events?*

Bader: Each year, iNEMI holds 2–4 workshops, which are scheduled according to member/industry needs and opportunities. These meetings are often held in conjunction with industry conferences. Public workshops provide a platform for sharing solutions and best practices as identified by participants. These events spend a significant portion of time exchanging ideas through small break-out groups, and a key result, or output, of each workshop is a set of prioritized challenges to be addressed by industry and/or individual firms in follow-up activities. We also regularly schedule webinars to discuss project outcomes, roadmap results and research initiatives. Some of these are members-only, and others are open to the industry.

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INEMI: LEADING THE WAY TO SUCCESSFUL ELECTRONICS MANUFACTURING

Bill Bader, CEO, International Electronics Manufacturing Initiative (iNEMI).

***Las Marias:** How do you best serve your membership?*

Bader: iNEMI's greatest advantage is the opportunities we provide our members for collaboration. We have two primary areas of activities: technology roadmapping and collaborative R&D. Through our biennual roadmap, we look 10 years into the future to identify the key issues and challenges for various market segments as well as technology sectors. We then conduct gap analyses to define research priorities and form collaborative projects in these areas. With more than 20 years of experience, iNEMI has developed a well-proven methodology for managing collaborative R&D. Our projects give members the opportunity to work with many of their peers in the supply chain to address some of the tough challenges that one company cannot solve on its own.

***Las Marias:** How much does membership cost?*

Bader: There are two types of membership: Participating Members (for-profit organizations) and Affiliate Members (non-profit organizations). Annual membership fees for Participating Members are based on annual sales, and range (in U.S. dollars) from $5,000 (for up to $5 million in sales), to $75,000 (for $15+ billion in sales). Government agencies and laboratories as well as research institutions pay $10,000, and university membership is $5,000.

***Las Marias:** Explain how membership is worth the cost.*

Bader: The collaborative nature of iNEMI's initiatives means that the dollars invested in membership are significantly multiplied. By leveraging the efforts and resources of multiple participants, iNEMI reduces the risk and cost to any one organization. There is also reduced cost of implementing new technologies, along with reduced risk of technology introduction; development of industry infrastructure (i.e., a source of supply); and ensuring reliability and technology readiness when required. Our efforts often result in improved yields and in improved field failure rates, both of which have a dramatic effect on manufacturing costs. For suppliers, iNEMI offers a great opportunity to have their service offerings evaluated by some of the best end users in the industry, thus offering wonderful business opportunities. For universities the exposure and partnership with industry is key to their delivering highly valued research and academic offerings.

iNEMI membership also provides the critical mass required to effect significant changes, such as setting direction for future technologies, influencing the supply base to develop solutions that will support product roadmap needs, and driving standardization to reduce cost and complexity.

***Las Marias:** What resources are most important to iNEMI members?*

Bader: The technology roadmap can be invaluable as a tool to guide investments in dollars and resources at member firms. Understanding market and technology direction is key to making the right investments and the iNEMI roadmap enables smart choices. We have member testimonials to that effect.

***Las Marias:** How do you satisfy members' need for technical information, and in what format?*

Bader: The iNEMI roadmap, which is published every other year, is not only free to members but is also available to them three months prior to going on sale to non-members. The roadmap is organized into individual chapters on market segments and technology areas and can be downloaded from the iNEMI website.

When iNEMI projects are completed, project teams typically report their findings to the membership as a whole through webinars and, in some cases, written reports.

We also have a research webinars series that highlights research activities at universities and research institutes.

***Las Marias:** Please highlight some of iNEMI's success stories in the industry.*

Bader: iNEMI played a pivotal role in the electronics industry's transition to lead-free assembly. The original Pb-Free Assembly Project recommended an industry-standard alloy (Sn3.9Ag0.6Cu) to replace tin-lead solders for reflow. The team then conducted extensive testing to characterize the new materials and demonstrate reliability, plus defined modeling and data needs for Pb-free solders. Follow-on projects addressed Pb-free assembly and rework, and wave soldering.

By focusing on a single Pb-free alloy, iNEMI helped industry accelerate convergence on standard solder formulations, manufacturing processes and, ultimately, contributed to timely and cost-effective conversion to Pb-free assembly. This project moved the industry forward in knowledge and understanding of Pb-free materials and processes.

iNEMI's tin whisker work evolved from its initial Pb-free efforts. A series of successful projects made significant contributions to industry's understanding of, and tools for managing, tin whiskers. Project teams identified tests to predict whisker formation, focused on the root causes of whiskers, and developed guidelines for minimizing risk of failure from tin whiskers in high-reliability electronic applications. Several of the guidelines, specifications and recommendations developed by iNEMI's tin whisker projects were leveraged into industry standards:

- JEDEC standard JESD22-A121, Test Method for Measuring Whisker Growth on Tin and Tin Alloy Surface Finishes (released in May 2005)
- IPC/JEDEC document JP002, Current Tin Whiskers Theory and Mitigation Practices Guideline (published in March 2006)
- JEDEC standard JESD201, Environmental Acceptance Requirements for Tin Whisker Susceptibility of Tin and Tin Alloy Surface Finishes (published in March 2006)
- IPC/JEDEC joint publication JP002, Current Tin Whiskers Theory and Mitigation Practices Guideline

iNEMI's HFR-Free program helped evaluate and direct the technology readiness, supply chain capability, and reliability characteristics for HFR-free printed circuit board materials and assemblies. iNEMI's efforts helped companies

move toward HFR-free by demonstrating that the key electrical and thermo-mechanical properties of the new HFR-free laminates could meet required criteria—even for high-reliability applications—and by providing the data needed to understand which materials were good for which applications.

The team's testing found that, in many cases, HFR-free laminates out-performed their halogenated counterparts. The data demonstrated

"The team's testing found that, in many cases, HFR-free laminates out-performed their halogenated counterparts."

that HFR-free laminates were available and well suited for today's higher-reliability products/applications. Furthermore, working closely with suppliers over the span of several projects, iNEMI was able to help them not only improve their material sets but also increase the availability of these materials.

***Las Marias:** What types of committees/teams are currently active?*

Bader: Work on the 2017 iNEMI Roadmap is currently underway, and there are 26 active groups: six Product Emulator Groups (PEGs), which look at product sectors, and 20 Technology Working Groups (TWGs) that assess technology areas. Unlike other industry roadmaps, the iNEMI roadmap covers the complete electronics manufacturing supply chain.

Also, iNEMI currently has active projects in the areas of board assembly, environmentally sustainable electronics, medical electronics, MEMS technology, optoelectronics, organic PCB, packaging, test and automotive electronics.

***Las Marias:** How do you cooperate with other associations?*

Bader: We work closely with 10–15 associations and consortia on development of the roadmap (it varies by year). We also have in-kind memberships with another 10 associations and consortia. We track the activities of these other organizations, and keep them informed of ours. In recent years, we have co-sponsored events with organizations such as SMTA (Surface Mount Technology Association), IEEE (Institute of Electrical and Electronics Engineers), MEPTEC (Microelectronics Packaging and Test Engineering Council), and TPCA (Taiwan Printed Circuit Association).

Whenever any of our projects develop guidelines or specifications that have the potential to become the basis for industry standards, we work closely with the appropriate standards bodies to "hand off" our findings and, in some cases, the iNEMI project chair has gone on to chair the standards committee.

***Las Marias:** How does iNEMI assist members in dealing with government agencies?*

Bader: We are not a lobbying organization, thus we do little direct dealings with government. On the other hand, our work in fields such as sustainability is well-known by key government bodies around the world and we do interface with them to keep them informed of the key work of our membership and significant directional issues where alignment of government and industry is beneficial.

***Las Marias:** Why should someone join your association?*

Bader: iNEMI offers companies the opportunity to get involved on some of the tough issues the industry faces and deliver meaningful results. They can work with other companies from throughout the supply chain that are facing the same problems and leverage their resources to collaboratively tackle the challenges that no one company can solve on its own. The strength of iNEMI is our leading industry membership and being a part of this unique community provides members with learning opportunities that can have great impact on the corporate bottom line. **SMT**

iNEMI's Current Collaborative Projects in the Areas of Board Assembly and Packaging

Quantify Impact of Board Design and Process Control on SMT Performance
Project Leaders: Sandeep Sane and Ram Viswanath (Intel)
Status: In formation

Warpage issues can significantly affect SMT yield. iNEMI has ongoing projects focusing on package warpage characterization (description below); however, the impact of board design, warpage, paste print and process temperature on SMT yield is not well understood. This initiative proposes to study those gaps and investigate board warpage and its correlation with SMT yield.

Ultra Low Loss Laminate/PCB for High Reliability and Performance Project
Project Leaders: Gary Long and Stephen Tisdale (Intel); Mason Hu (Cisco)
Status: In process

This initiative is addressing key technology challenges and measurement capabilities needed to deliver ultra-low loss, high-reliability PCB laminate and board performance. Options are currently limited for low-cost, high-performance PCB materials capable of high-volume manufacturing (HVM) processing. High layer count/multi-layer constructions are becoming increasingly complex with fewer material options. This initiative was organized to close major gaps and evaluate new materials based on electrical and thermo-mechanical capabilities for high-layer-count/multi-layer applications. Test boards are in fabrication at four sites. Electrical and mechanical testing will begin soon.

Warpage Characteristics of Organic Packages, Phase 3
Project Leaders: Wei Keat Loh (Intel), Ron Kulterman (Flextronics) and Tim Purdie (Akrometrix)
Status: In sign-up

The influence of package warpage on assembly quality and reliability are receiving increasing attention across the industry. In its first two phases, the iNEMI Warpage Characteristics of Organic Packages Project carried out a broad experimental program to characterize ball grid array (BGA) package warpage using thermo moiré. The output of the previous work can be found on the project webpages. As the project has gained significant interest from industry, the team has decided to continue this effort with a third phase, which plans to:

- Identify measurement methods and protocols based on the different measurement techniques and technology, such as: confocal techniques, projection moiré techniques, thermo moiré techniques with or without convective reflow, and 3D digital image correlations (DIC).
- Benchmark or fingerprint package warpage characteristics to develop a better understanding of the current trends of warpage behavior for different package constructions.

Bi-Sn Based Low Temperature Soldering Process and Reliability
Project Leaders: Raiyo Aspandiar and Scott Mokler (Intel)
Status: Project plan submitted; expect project start in January

Higher energy costs are driving ODMs to reduce power usage in manufacturing processes and the lower temperatures in reflow ovens can save significant amount of energy. Lower reflow soldering temperatures can mitigate the warpage impact on solder joint yields (a problem that has been exacerbated recently by the burgeoning of ultra-thin electronic packages for slimmer and lighter electronic products with increasing performance). Bi-Sn solder pastes are most appropriate candidates for these lower temperature processes, but Bi-Sn solder is brittle and mechanical/shock reliability of solder joints is not robust enough for mobile products. New developments to overcome this drawback are ductile Bi-Sn solder pastes and joint reinforced Bi-Sn solder pastes but the effectiveness of these pastes to enhance solder joint reliability has not yet been established.

This new initiative is proposed to identify and select available ductile and joint reinforced Bi-Sn solder pastes, develop high yield (>95%) reflow soldering process for a variety of test components and board surface finishes using these Bi-Sn solder pastes, and assess the solder joints' reliability. SMT

SEIPI:
Fueling Companies' Transition to Global Players

by Stephen Las Marias
I-CONNECT007

I recently interviewed Arthur Tan, chairman of the Semiconductor and Electronics Industries in the Philippines Inc. (SEIPI), about the association, its main goals and vision, and how it helps members in their journey to become global players in the electronics manufacturing industry.

***Stephen Las Marias:** What is SEIPI's basic mission?*

Arthur Tan: The basic mission of SEIPI is to provide an organization or community for all the different companies, directly and indirectly related, that are involved in electronics, semiconductor, and electronics manufacturing in the Philippines. It's a way to be able to provide a voice to talk to the government to help define policies in order to provide further growth for the industry—the direct and the most immediate effect of which is being one of the largest dollar export generators for the country.

There's also the direct employment that the industry does for the country. That's another mission of the association, to further provide inclusive growth for the country, since we are one of the few industries that can actually hire high-school graduates into our operations. The requirements for us to hire is wider in terms of the need of the country for employment. So from high school graduation, even if you don't have a college degree, or even if you're just in college or you had some post high-school preparatory college units, you can already join our workforce. Then the industry provides specific training.

SEIPI aims to provide a voice for all the different companies that are involved in this industry; to be able to provide inclusive growth through direct employment, especially for one of the largest demographics of the country; and then of course, to provide a sustainable business environment for the country.

***Las Marias:** Please tell us about your events.*

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Tan: The big ones that we just concluded was the CEO Forum, which was actually held in Malacanang and was keynoted by the Philippine President himself. We do this once a year in October. The other big event is around June, and that is the Philippine Semiconductor and Electronics Convention and Exhibition (PSECE), where we have a fair with exhibitors from all over the world, and with different technical forums by the different networking committees, which provide information that is happening in the different facets of our business.

Las Marias: *What are the top benefits that SEIPI brings to members?*

Tan: The government policies are key in being able to either be a catalyst for growth or a barrier for the industry. A lot of times, the lawmakers and all the people will always have good intentions, but not really think through the effects of these policies. So the association is the one that actually oversees all of these different rules and regulations that the government is trying to implement, and make sure that these are properly heard and reviewed before any of them are implemented.

The second one is the ability to be able to access best practices. We are able to provide assistance to small and emerging companies that want to get better, because we have large institutions that already have the wherewithal and the experience—so then it becomes a teaching organization. That's another benefit.

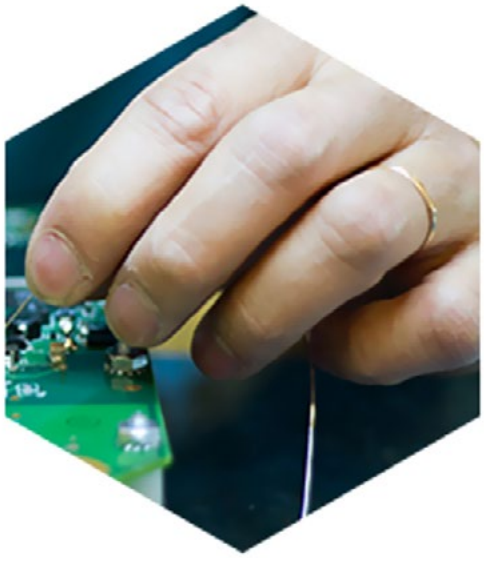
I think the other one is that it's a very structured and organized association. It's been operating for more than 30 years now, so there's a lot of knowledge that's already been incorporated into the organization. We are always asked to sit, not only at a national, but also at a global table for defining the rules or policies that would affect not only the business but also the environment and the community. Those are the things that I think are critical.

Las Marias: *Does membership require a cost?*

Tan: It's a variable cost. Depending on the size of your organization, the number of employees that you have, the amount of revenue that your company makes, there's an appropriate membership fee to it. So it's not a flat fee for everybody; it actually depends on the size of the company.

Las Marias: *What resources are available or are being provided by the association to its members?*

Tan: The association serves as an intermediary between the different companies and the government. So if you are just a small company and you have an issue with a government agency, chances are you are not going to be heard. But if you are a member of SEIPI, you are represented by a 300-strong largest export dollar industry for the country, and your issues are noticed. That's the biggest advantage that SEIPI brings.



The second part is to have the ability to have access to a wide range of network. Not only within the government, but also within the different institutions that are also involved with SEIPI.

Las Marias: *How do you satisfy the members' need for technical information?*

Tan: Apart from the PSECE, we have another forum that is purely technical, where each individual company presents a breakthrough idea or a learning experience that is disseminated to all the different companies who attend. Aside from that, there are active 'networking groups' within the organization that are subdivided according to different disciplines necessary to run our businesses. So we have a networking group for human resources, for technical training, and for dealing with logistics and traffic management, among others. That is another key benefit that the members get.

Las Marias: *Does SEIPI have a roadmap of some sort for its members?*

Tan: Each individual company has their own roadmap both from the business level and technology level. What SEIPI tries to do is to capture a business and technology roadmap as a blueprint for the country. To set up its proper policies in order to attract the right type of companies to invest in the Philippines and to provide the right environment to those that are already here to continue to expand and to thrive. So it's a two-fold roadmap that we are looking at: how to make sure that the Philippines continues to be a relevant player within this market, and that both manufacturing and electronics industries continue to be key components of growth for the country.

SEIPI creates a roadmap both on technology as well as business in order to guide the policy makers in the country, in terms of what kind of support that will help attract these kinds of businesses. At the same time, these are also the things that we need in order to make sure that those already here grows.

Las Marias: *Any final comments?*

Arthur Tan, chairman of SEIPI.

Tan: We are not a young organization. What I would like to share is that, to be able to make the association continue to be relevant and to be sustainable, it is imperative that the younger companies and younger leaders of existing companies become more involved in the association. This way, we can get fresh ideas and thought processes into the organization to make it much more viable.

What I don't like is the same thinking and ideas just propagating year-over-year. I don't think that's healthy, primarily because the economy is changing, the way business is being transacted is changing, and the consumer himself is changing. So to be viable and sustainable, I think the association itself has to reinvent and innovate on its own.

I think that's the message that I would like to give the membership, and hopefully everyone takes responsibility in making sure that happens.

Las Marias: *Thank you for your time, Arthur.*

Tan: Thank you, Stephen. **SMT**

Digitalization on the Horizon

by Jorey Guzman
SIEMENS INDUSTRY

Manufacturing on the Rise

The manufacturing industry in Asia has been increasing steadily in size and contribution to the global economy. No longer is Asia seen as the low-cost manufacturing haven for multinational companies looking to take advantage of scale and labor cost; the region has been stepping up their innovation and quality to compete in the global market.

Together with the industry's boom comes the need for factories to optimize their processes and iron out issues that could potentially lead to inefficiencies. Looking at the bigger picture, the requirement for advanced factories is more pressing. In Southeast Asia, for instance, the ASEAN Economic Community—the goal of which is regional economic integration by the end of this year—is expected to present bigger opportunities for manufacturers in the region while at the same time offer challenges in terms of increased competition.

As manufacturers look to the future, they need to examine how advanced information and communication technologies can boost their value creation.

Smarter Manufacturing

In the evolution towards the smart manufacturing paradigm, end-user requirements are set to evolve and become more complex than ever before. Global suppliers find it increasingly difficult to meet the growing needs of the end-users that are further augmented with a very high degree of complexity. But the current scenario will also provide the biggest opportunity to realign one's existing business approach and forge alliances and partnerships with market participants, according to Frost & Sullivan. The result would be a newly built supplier ecosystem that can effectively address end-user needs for growth in near- and long-term perspectives.

In Germany, this development is called Industry 4.0. Similar initiatives have been launched in other European countries, the United States, China, and elsewhere. Industry 4.0 aims to achieve production-related advantages by creating a networked, flexible, and dynamically self-organizing manufacturing process for highly customizable products.

Over the next 15 to 20 years, it is expected to be accompanied by a paradigm shift that could justifiably be called the fourth industrial revolution. The result will appear to be revolutionary from today's point of view, but ultimately it will involve a large number of development steps in a process of evolution.

According to Frost & Sullivan, a new wave of influence is disrupting business dynamics between end-user and supplier. This change is founded on new service paradigms—founded on frameworks defined by advanced information and communication technology (ICT)—that are enabling end-users to achieve high degrees of cost optimization and enhanced operational efficiency. Services based on such advanced ICT concepts, were found to hold more than 75% of the global industrial services market in 2014.

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"In order to design and deliver such advanced services, industrial suppliers are required to forge partnerships with cloud and data analytics vendors. In some end use cases, even the most rudimentary solutions built on an integrated analytics package have enabled suppliers' upsell and increase product prices by up to 10%. It also helped achieve differentiation in a technology saturated market place," notes Muthukumar Viswanathan, practice director for industrial automation & process control and measurement & instrumentation at Frost & Sullivan.

Major structural revisions are also expected on the shop floor driven by the advent of M2M (machine-to-machine) communication. By 2020, nearly 12 billion devices in the industry are poised to be connected via advanced M2M technology.

Advent of Digital Factories

The concept of a "digital factory" remains something that industry players continue to grapple with. What it really represents is a complete digitalization of the whole value chain, allowing for the use of digital models, methods,

A New Era of Manufacturing

The emerging Asia economies' manufacturing industry are fertile markets for factory and process automation. There remains a lot more room for automation to be adopted or upgraded in factories. Technology progression offers manufacturers more and more viable alternatives to improve and gain a competitive edge. Smart manufacturing is one of them.

Smart Manufacturing

What smart manufacturing represents is the industrial internet of smart, connected factories and production plants. It enables integration and data sharing within the organization whereas normally, in a typical manufacturing plant, each process is a separate working entity.

There are two main elements of smart manufacturing that are captured in many of the automation solutions provided by global vendors. The first is a manufacturing execution system (MES) that monitors and manages work-in-progress on the factory floor. It can capture all manufacturing information in real time, even across different geographical locations.

The second is the merging of the product and production lifecycle where the entire process, from inception to engineering design and assembly, is integrated and captured in the form of a common data model. This enables businesses to make unified, information-backed decisions at every stage of the product lifecycle.

Greater Productivity and Efficiency

The factory's productivity is sometimes hampered by the lack of information needed to execute decisions and optimize processes. This is especially so when global companies have multiple factories based in different countries. MES gives manufacturers and employees real-time visibility of the factory's floor data, allowing for faster information flows and better control and synchronization of resources. Fact-based decisions can be made more quickly and equipment malfunctions can be instantly detected.

Aside from being more productive, merging the product and production lifecycle also increases resource efficiency. Consolidating the data captures learning points and best practices at each stage of the product lifecycle, enabling for tried-and-tested resource allocation methods to be employed. Potential hiccups are minimized and consequently, fewer resources are wasted.

Technological Advancement

Along with the rise and fall of consumer demands comes the need to adapt accordingly. Not only is expanding production capacity by employing more workers or building bigger factories important in meeting the growing demands, but also ensuring the processes are streamlined and integrated through smart manufacturing. This will contribute towards the factory's overall productivity and efficiency in the long run.

and applications to plan and design manufacturing facilities and processes. This is aided by specific software that optimizes the interoperability of various process components or to develop virtual products for example.

Digitization trends are bringing new efficiencies to the industries. Big data analytics and advanced prognosis solutions will help optimize the operational flows and improve the revenue margins in companies. For example, big data analytics and predictive intelligence platforms can make the production lines in manufacturing facilities faster by 30% (by eliminating redundant activities), according to Frost & Sullivan.

Although the prevalence of digital factories is low at the moment, analysts predict that its basis of operation—seamless data integration—will increase in importance in the near future. For instance, global automotive companies such as General Motors, Ford and Toyota, see the potential of this digital system and have taken steps in its direction.

The Power of Simulation

When a digital factory is set up, simulation of a virtual production line is made possible. The required type, volume and placement of machines for a new production process can be determined. More importantly, the actual production process can be simulated and tested for errors and issues that may be overlooked in the planning phase. Overall, three key areas can be enhanced using simulation: productivity, efficiency and flexibility.

Simulations of a new production line will be built on real-time data to closely resemble the physical world. For example, to prepare for a sudden surge in demand, increasing the output setting can be used to test the viability of the production line. This can create bottlenecks along the line due to insufficient robots or manpower deployed at a specific station. Resolving such problems through tweaking the production line design will improve productivity when it is implemented.

Simulation also results in efficiency optimization as well as bigger cost savings. Proceeding straight to physically testing the actual production process would put a strain on the company's finances if issues were to occur. When the simulation predicts high success, the particular production design would have a potentially higher chance of swift implementation with minimal downtime.

The ability to simulate allows for flexibility in changing production lines. In a time of ever-changing consumer demands and governmental policies, the factory's ability to switch accordingly is vital to its survival. Additionally, software that enables the transfer of digital data after simulation into real production speeds up and allows for faster production changes.

"Digitization trends are bringing new efficiencies to the industries. Big data analytics and advanced prognosis solutions will help optimize the operational flows and improve the revenue margins in companies."

Anticipating a Virtual Future

After analyzing the current trends and statistics, it is clear that digital factories are set to transform the manufacturing landscape in the near future. With simulation elevating and optimizing new manufacturing designs, the concept of digital factories would be especially helpful for factories in the Asia to expand or change their production lines. SMT

Jorey Guzman heads the product management for factory and process automation of Siemens Industry in the ASEAN Region.

KNOCKING DOWN THE BONE PILE

No Time for a Board Spin? Selective Solder Mask Removal

by Bob Wettermann
BEST INC.

What do you do when you need solder mask removed quickly? What do you do when you get the boards back from the shop and there's a missing pad, or your design team did not catch the design error in the pad or trace area, resulting in mask where it's not supposed to be? Perhaps the test group tells you the RF shields need to have the trace opened up in order to pass the testing, but there are literally thousands of boards in the supply chain needing this modification. In these cases solder mask needs to be removed—usually in a hurry—in order to fix these problems.

Outside of re-spinning the board and starting over, there are several processes that can selectively remove solder mask in a controlled and consistent fashion. Some are better controlled than others and include mechanical abrasion, chemical etching, and micro and laser ablation.

Several factors will help determine the method to use including the type of solder mask, and where the area of interest is located. Other factors are the quantity of PCBs, the amount of solder mask needing removal and whether the circuit boards are bare boards or are populated with components.

Grinding and Scraping

One of the most straightforward methods of mask removal is via scraping or grinding of the soldermask (Figure 1). Since solder mask is only a little more than 1mil in thickness it does not

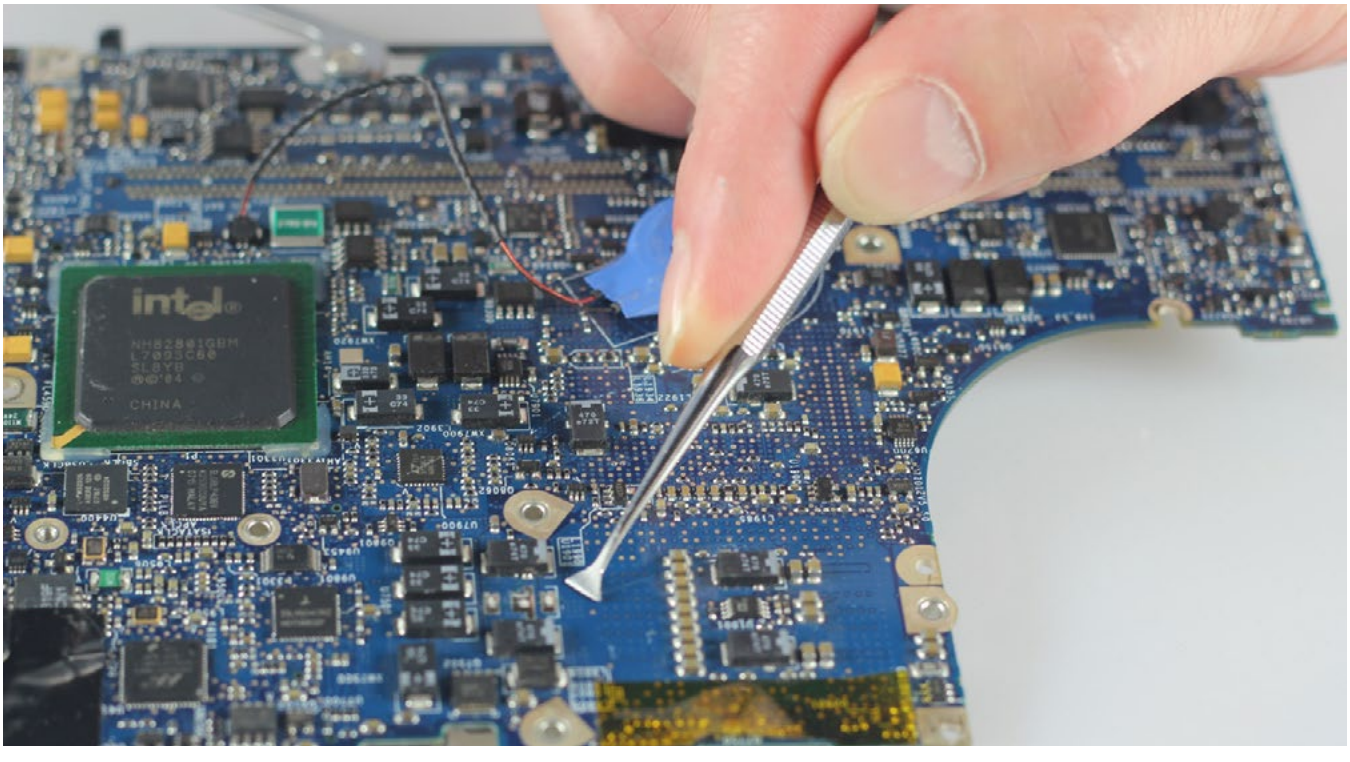
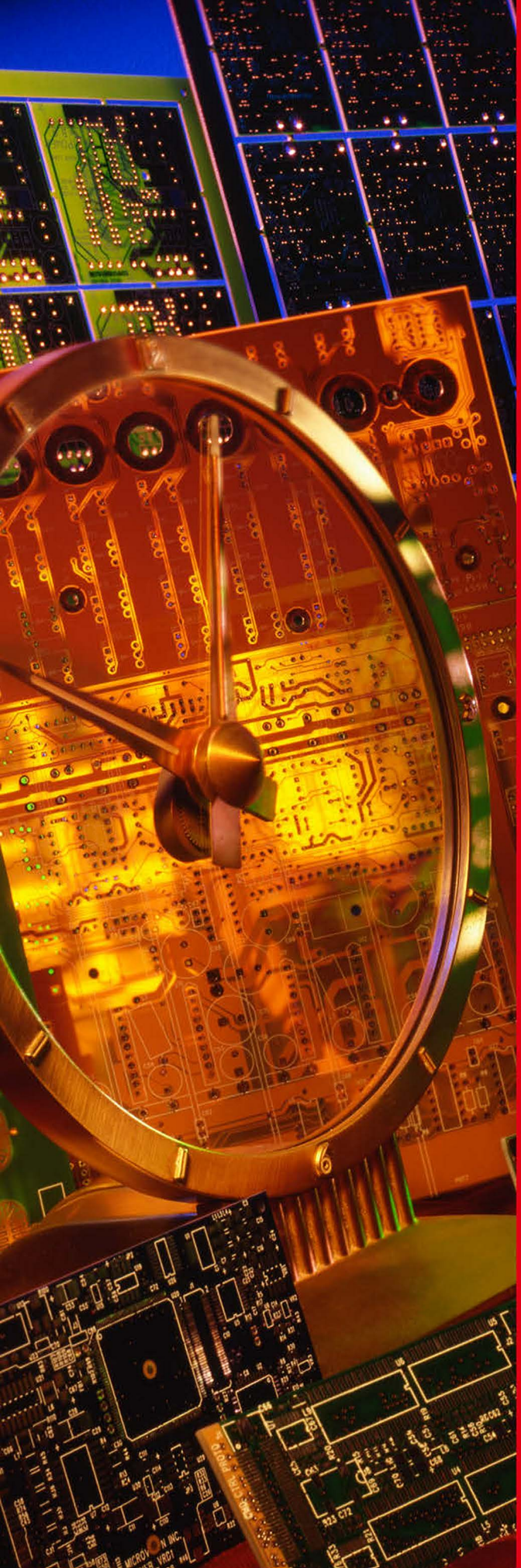


Figure 1: Selective manual scraping of solder mask.



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require a large mechanical force to scrape it off. With either the use of a knife, scraper, pick or eraser, thin layers of mask can be removed by a skilled and certified repair technician. A multitude of equipment rework stations containing drills, grinders, rotating brushes, and the like are commercially available that the rework technician can use (Figure 2).

There are several drawbacks to this process, namely operator fatigue on large projects, and the lack of repeatability when ultra fine dimensional requirements need to be adhered to. Even with steady hands and fabricated masks the tolerances that can be held by skilled personnel is to ±10 mils. In addition, the depth control using this technique is very poor and underlying laminate or copper layers may be damaged as there is a lack of depth control. The positive aspects of this method are that no special set-up is required and it can be done by almost anyone for prototype or low-volume rework.

Another method that can control the depth of the cut is through the use of a milling machine to remove the solder mask. It is a more precise technique for removing solder mask than using a manually-controlled depth cut of a hand grinding tool. Since high-speed cutters are used when milling, precision depth control is essential since the cutters will tend to pull into the coating and may penetrate into the board surface.

Not damaging the underlying laminate is the key risk in using this approach. Turning the milling cutter in the opposite direction can be an effective technique for controlling the depth. Operator skill and experience as well as board fixturing are paramount to making this technique work.

Chemical Means

Another method for solder mask removal relies on a chemical stripping agent and is most effective when removing solder mask from copper or soldered surfaces. Tapes and other masks or other protective materials are placed on the PCB surface to isolate the area before the chem-

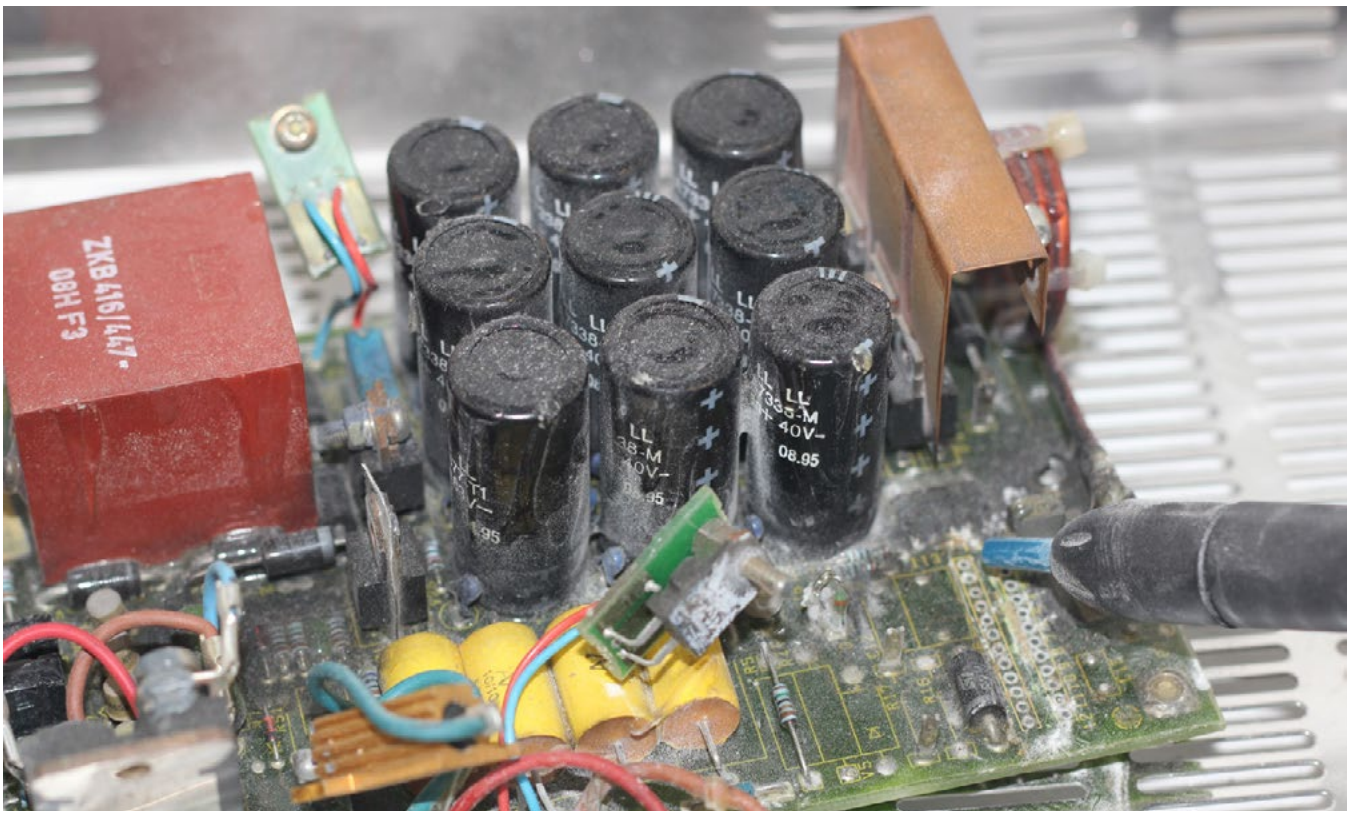

Figure 2: Microabrasion on a PCB.

ical stripper is applied. The chemical will (mostly) strip the coating and break it down just like a paint stripper.

There are several negatives to this technique. Not only will the stripper remove the solder mask, it may also attack the base material surface if exposed for too long a period of time. In addition, testing of the stripping agent and its impact on neighboring components to the strip area is critical to proving out this technique. This means that chemical strippers must be used only if and when the alternatives don't make sense, and they must be used with great care, and the stripped and neutralized boards need to be handled carefully.

Micro Abrasion

Another method for selective solder mask removal includes micro ablation. In this method (appropriate for larger areas as the precision without a mask is very poor) an abrasive material is propelled pneumatically through a pencil-shaped hand piece to ablate the coating. A variety of materials (which include, but are not limited to ground walnut shells, glass or plastic beads, and sodium bicarbonate powder) of different hardness can be used to break down the mask. The size of the particles and the makeup of the material will determine the desired result on the mask. Air pressure and tip geometries will impact the output air velocity propelling the media, which in turn will remove the solder mask. This method, which requires excellent dexterity, uses high-velocity abrasive particles accelerated and directed through a nozzle, as shown in Figure 2, and care must be taken to control the depth of the removal effect and avoid undue stresses on device leads. The lack of control in this process means that only the most experienced and skilled operators should perform this technique.

One of the downsides of this approach is that the process creates substantial friction, and static charges in the process and therefore built-in ESD protection is required. When working on circuit boards containing static sensitive devices, the micro-blasting system must be designed to eliminate potential ESD damage. Many microabrasion systems have anti-static ionizers and grounding points contained within the unit. Significant preparation time including masking is often needed to control the areas to be removed and help to prevent unwanted laminate of component damage. Finally, a thorough cleaning will be required to flush away any blasting material from the circuit board and operator skill and training are essential.

Selective Laser Ablation

In yet another method, mask can be ablated away using a properly controlled power level, laser source and frequency to expose the copper

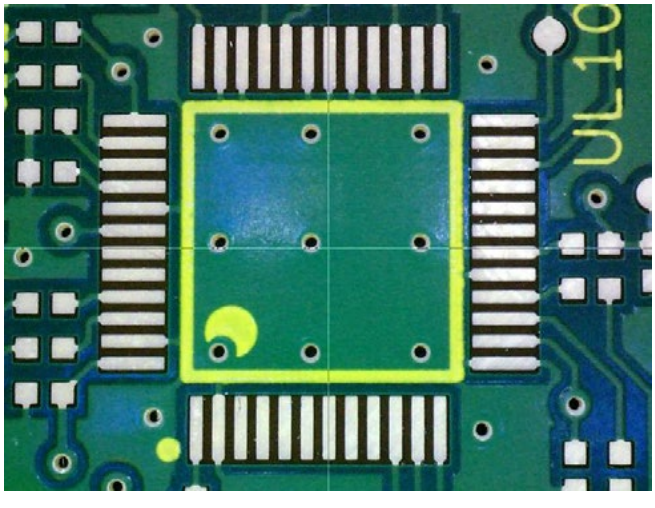

Figure 3: Solder mask on center ground area of QFN.

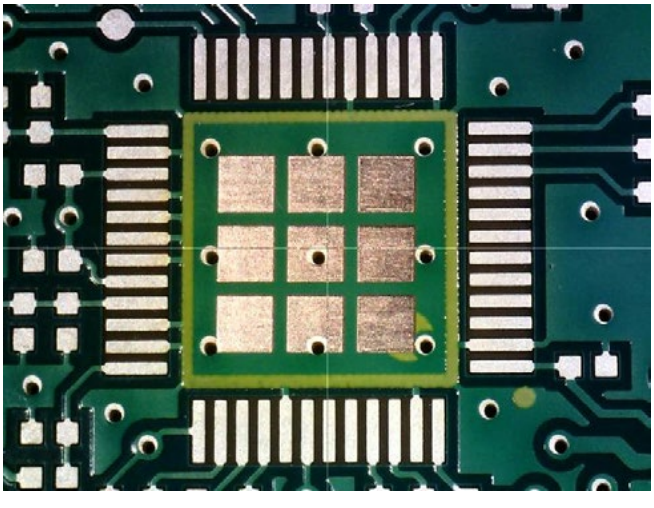

Figure 4: Solder mask on center ground area of QFN ablated in "window pane" pattern.

or laminate, effectively creating a trace, which can have very fine line definition (Figures 3 and 4). This method, while having engineering and set-up costs not present to near the degree of the more manual methods, has several benefits.

There are several benefits to using this particular approach. First, line definitions achieved by the laser are very tight with 0.5 mil traces and spaces well within the capability spectrum of most lasers. Second, very complex trace paths, which are very time consuming to hand fabricate, are easy to fabricate with a laser. A beam steering mechanism can make this happen based on the pattern programmed into the machine. Finally, due to the processing speed and the ability to process "multiple-up" panels at the same time on the laser, the cost for rework is greatly reduced versus other methods on a per-piece part basis. The cost per-piece part for rework is a fraction of the same work done manually, with the difference becoming more pronounced as the patterns get more complex and the volumes increase.

Conclusion

There are several way to remove solder mask selectively from a PCB when required. The methods of scraping, chemical etching, micro abrasion and a directed laser ablation technique can have their positive and negative attributes. For a few boards the mechanical scraping or grinding off of the solder mask is a method that is well-suited for low-volume, non-high-precision work while the laser ablation method is the right choice when ultra precision or high-volume is required. Each of the methods to be considered need to be weighed against the speed, accuracy and repeatability required for the work at hand. SMT

References

1. IPC 7721 Rework, Modification and Repair of Electronic Assemblies, Method 2.3.5—Grinding and Scraping.

2. IPC 7721 Rework, Modification and Repair of Electronic Assemblies, Method 2.3.6—Micro Blasting Technique.

3. IPC 7721 Rework, Modification and Repair of Electronic Assemblies, Method 2.3.2—Solvent Technique.

Bob Wettermann is the principal of BEST Inc., a contract rework and repair facility in Chicago.

Flat Camera Looks into the Future

Rice University researchers have developed a camera that is a little more than a thin sensor chip with a mask that replaces lenses in a traditional camera. Invented by the Rice labs of Electrical and computer engineers Richard Baraniuk and Ashok Veeraraghavan, FlatCam can be fabricated like microchips, with the precision, speed and the associated reduction in costs. Without lenses, the most recent prototype is thinner than a dime.

"As traditional cameras get smaller, their sensors also get smaller, and this means they collect very little light," Veeraraghavan said. "The low-light performance of a camera is tied to the surface area of the sensor. Unfortunately, since all camera designs are basically cubes, surface area is tied to thickness. Our design decouples the two parameters, providing the ability to utilize the enhanced light-collection abilities of large sensors with a really thin device."

FlatCam shares its heritage with lens-less pinhole cameras, but instead of a single hole, it features a grid-like coded mask positioned very close to the sensor. Each aperture allows a slightly different set of light data to reach the sensor. Raw data sent to the back-end processor is sorted into an image. Like much larger light field cameras, the picture can be focused to different depths after the data is collected.

Rice's hand-built prototypes use off-the-shelf sensors and produce 512x512 images in seconds, but the researchers expect that resolution will improve as more advanced manufacturing techniques and reconstruction algorithms are developed.

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Sparton Acquires Hunter Technology Corporation

Sparton Corporation announced that its wholly owned subsidiary, Sparton Hunter Corporation, completed a merger with Hunter Technology Corporation in a $55 million all-cash transaction. The merger is subject to certain and conditional post-closing adjustments.

Jabil Opens Innovation Center

Strategically located in the Silicon Valley, the 100,000-square-foot Blue Sky Center features Jabil's intelligent digital supply chain toolset called Jabil inControl, factory-of-the-future technologies, state-of-the-art IoT and rapid prototyping labs, as well as access to advanced capabilities for increasing customer collaboration and product innovation.

Scanfil Expects Growth Momentum to Continue in 2015

Scanfil expects its turnover to increase by 2–8% in 2015. More turnover is generated in the second half than in the first half of the year. The company believes that its turnover will decrease slightly in the first half of the year, and particularly in the second quarter, compared to 2014. Its operating profit before non-recurring items for 2015 is expected to be EUR 13–17 million.

Zentech Manufacturing Acquires Colonial Assembly and Design

The acquisition provides tremendous synergy with Zentech's established customer set in the DOD and military C4ISR (Command, Control, Computers, Communications, Intelligence, Surveillance, Reconnaissance) sectors while also providing enhanced engineering, product design, circuit design, machining, over-molded cable assembly and wire harnessing capabilities to the Zentech portfolio.

Alpha Opens Manufacturing & Training Facility in Chennai, India

Alpha is expanding its capabilities to meet the growing needs of its customers by establishing a new advanced manufacturing and training facility in Chennai, India. The facility, an addition to their existing 16,000sqm campus, will have the capability to produce ALPHA's vast product line including bar solder, cored wire, solder paste, wave solder flux and cleaners.

MMI Releases List of Top 50 EMS Firms Worldwide

In 2014, sales of the Top 50 EMS companies worldwide reached a new high of $265 billion – more than 4% or $10 billion than in 2013. Company growth rates in revenue ranged from 50+ percent to -20%, with the majority exhibiting very positive numbers.

Valtronic Wins Award from Mentor Graphics

Valtronic announces that Valtronic SA received 2nd place in Mentor Graphics' 25th annual PCB Technology Leadership Awards in the category of Industrial Control, Instrumentation, Security & Medical. Valtronic proposed a complex board for a magnetic resonance image receiver using Mentor Graphics' Xpedition Enterprise software.

Bittele Electronics Completes New PCB Assembly Line

Bittele Electronics, a Toronto-based firm specializing in prototype and low volume printed circuit board assembly, has completed the construction of a new, fully automated PCB assembly production line featuring state-of-the-art technology, for prototype and low volume assembly.

Plexus Secures Accreditation from U.S. DoD

Plexus Corp., today announced that its wholly owned subsidiary, Plexus Aerospace, Defense and Security Services, LLC, has received accreditation as a Microelectronics Trusted Source by the Defense Microelectronics Activity (DMEA).

Creation Technologies Welcomes Congressman Paul Ryan in Wisconsin Facility

"Creation Technologies is on the cutting edge of our economy. They're promoting innovation and creating the jobs of the 21st century. We've got to streamline the regulatory process so more manufacturers in southeast Wisconsin can expand opportunity from the bottom up," said Congressman Paul Ryan.

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Low-Temperature Thick Film Pastes Permit Lead-Free Soldering

by Steven Grabey
HERAEUS ELECTRONICS

New technologies in the printed electronics industry have fostered an increased interest in low-temperature polymer thick film products. Industry expectations are demanding that low-temperature products perform at the same level as their high-temperature counterparts, including high reliability, strong adhesion, and solderability with lead-free solders.

Much of the shift to lead-free solders is due to environmental concerns and legislation that has surfaced over the past 15 years. Traditionally, it has only been possible to use leaded solders for soldering to polymer-based thick film conductors. While using lead-free solders is beneficial both to the industry and the environment, they pose challenges during processing. The high temperatures required for lead-free soldering generate a harsh environment that is too severe for polymer thick film pastes to survive.

Using New Substrates

As the electronic industry moves towards flexible electronics, they are realizing the benefits in using substrates such as treated glass and aluminum that require a low-temperature-processing, polymer thick film. These materials not only offer a cost-effective approach to building complex, integrated circuits, they also provide a viable option to manufacturers dealing with the new demands of substrates that cannot handle temperatures higher than 500°C.

Polymer thick film materials have the versatility to be engineered depending on substrate and preferred application method such as screen printing, stencil printing, dispensing, dipping, and roll-to-roll printing. For traditional thick film materials, additive processing has always offered benefits including ease of use, simple design changes, and the ability to manufacture patterns from simple circuits to intricate designs.

The addition of polymer thick film to this category not only continues to have these listed advantages but also brings new gains such as: low temperature processing, quick-curing steps, and the ability to offer many of the same benefits as high-temperature thick film material without the need for the traditional firing step.

Despite the known advantages for polymer thick film materials, they are not as widely accepted in the industry as equivalent alternatives to their standard high-temperature thick film

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counterparts. This is due to two disadvantages – reliability and process-ability – prevalent in polymer thick films. Although many polymer thick films are considered to be reliable, they do not have the typical life span of a cermet (ceramic-metal) paste.

It is difficult to use lead-free solders when working with polymer materials. Frequently, the processing temperatures of the solders are greater than those of the polymers used to create the conductive pastes. This leads to the leaching of the conductive materials and the poor wetting of the solder.

To solve these problems, a new polymer thick film paste has been developed that is compatible with a variety of substrates and readily accepts lead-free solder. This easy-to-process paste features low temperature curing (150°C – 200°C); offers excellent solderability with SAC305 solder; and is RoHS- and REACH-compliant. It allows conductive polymer pastes to be used in a variety of functions such as position sensors, low-temperature heater applications, and tempered-glass connection points.

This article will present data that shows how the thick film paste was assessed under various parameters including solder acceptance, adhesion, and thermal and SEM analysis.

Raw Material Selection

To achieve a successful formulation, four characteristics were kept in mind. The resulting ink should be chemically durable, have high mechanical strength, achieve a conductivity of less than 35mΩ/sq/mil, and most important, be solderable with SAC305 solder. In order to attain these properties, careful selection and screening of raw materials was necessary.

Polymer Selection: Phenolic resin was chosen as the appropriate polymer for the development of the polymer paste because thermosetting resins are durable at elevated soldering temperatures; phenolic resin will not usually encapsulate silver in the curing process leading to better conductivity; and it has the ability to be cured at low temperatures.

Silver Selection: The primary goal of the silver selection was to manage solderability and conductivity. Silvers were observed at an 80% loading in a phenolic-based vehicle. More than 20 different silvers were compared for various powder/flake combinations as well as the evaluation of single-silver systems. Figures 1(a) and 1(b) show the SEM images of the final silver particles chosen for the final product.

A dip-soldering method was used to gauge each silver sample for its ability to accept SAC305 solder at 235°C. The substrates created for the initial solderability trials were 1-in. x 2-in. pieces of FR-4 (glass-reinforced epoxy laminate). Each substrate had a 0.5-in. x 2.0-in. section of paste applied to its center. The paste was cured at 150°C for 30 minutes and resulted in a cured thickness of 25–30 µm.

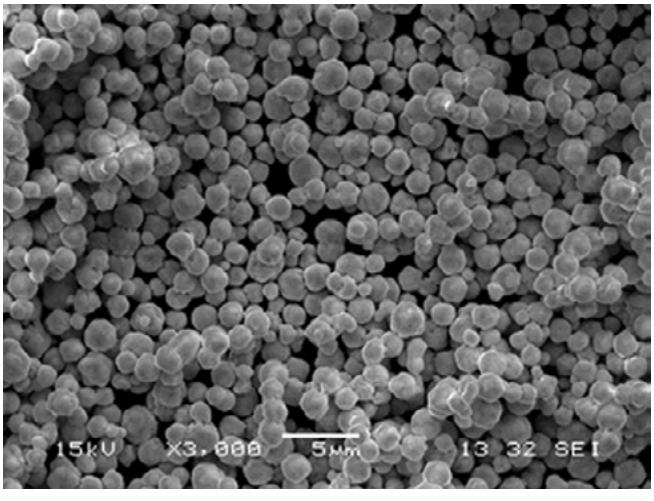


Figure 1a: Silver powder.

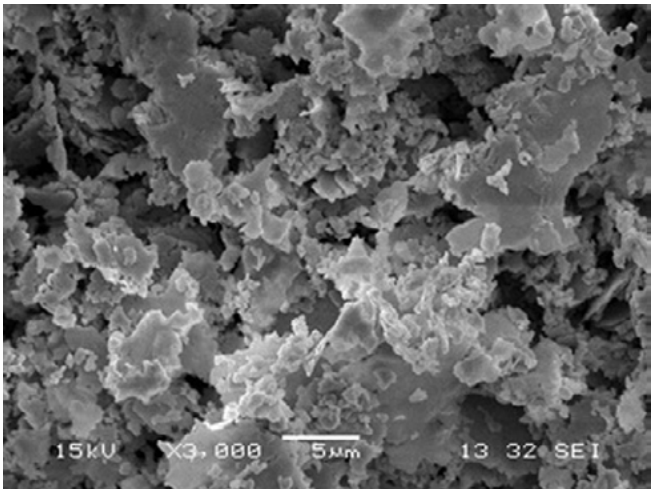


Figure 1b: Silver flake.

Silver Coating Selection: Silver coatings also played a role in the final selection of the silver used in the polymer paste. Fatty acids and hydrophilic coatings were assessed to determine optimal properties and compatibility. Overall, saturated fatty acids seemed to be most appropriate for the solderability and conductivity requirements of the polymer paste. Coating amounts ranged from 0.30 – 4.00% with the most desirable level being 0.40 – 0.60%.

Rheology and Printability

After requirements for solderability and conductivity were achieved, the pastes containing the preferred silvers were evaluated by screen printing. Using a 280 mesh, 0.5-mil-emulsion, stainless-steel screen, each paste was printed onto a 2-in. x 2-in. piece of FR-4 substrate. However, the addition of various additives was needed to achieve the most desirable printability and line definition.

Choosing the proper additives for a polymer paste is more critical than for a high-temperature firing paste. Usually, traditional cermet paste's inorganic materials will remain in the film after the burn-out process, but organic additives will be removed. When considering polymer thick film, both organic and inorganic materials will remain in the final film after processing. Thixotropic compounds added to any formulation of a polymer conductive paste will remain in the cured film and can diminish properties such as adhesion, solderability and conductivity.

Thermal Analysis

When defining the optimal curing temperature for a polymer conductor, a thermogravimetric analysis (TGA) must be considered. All volatile solvents must be removed from the polymer conductor's cured film. Furthermore, it is important to ensure that none of the polymer

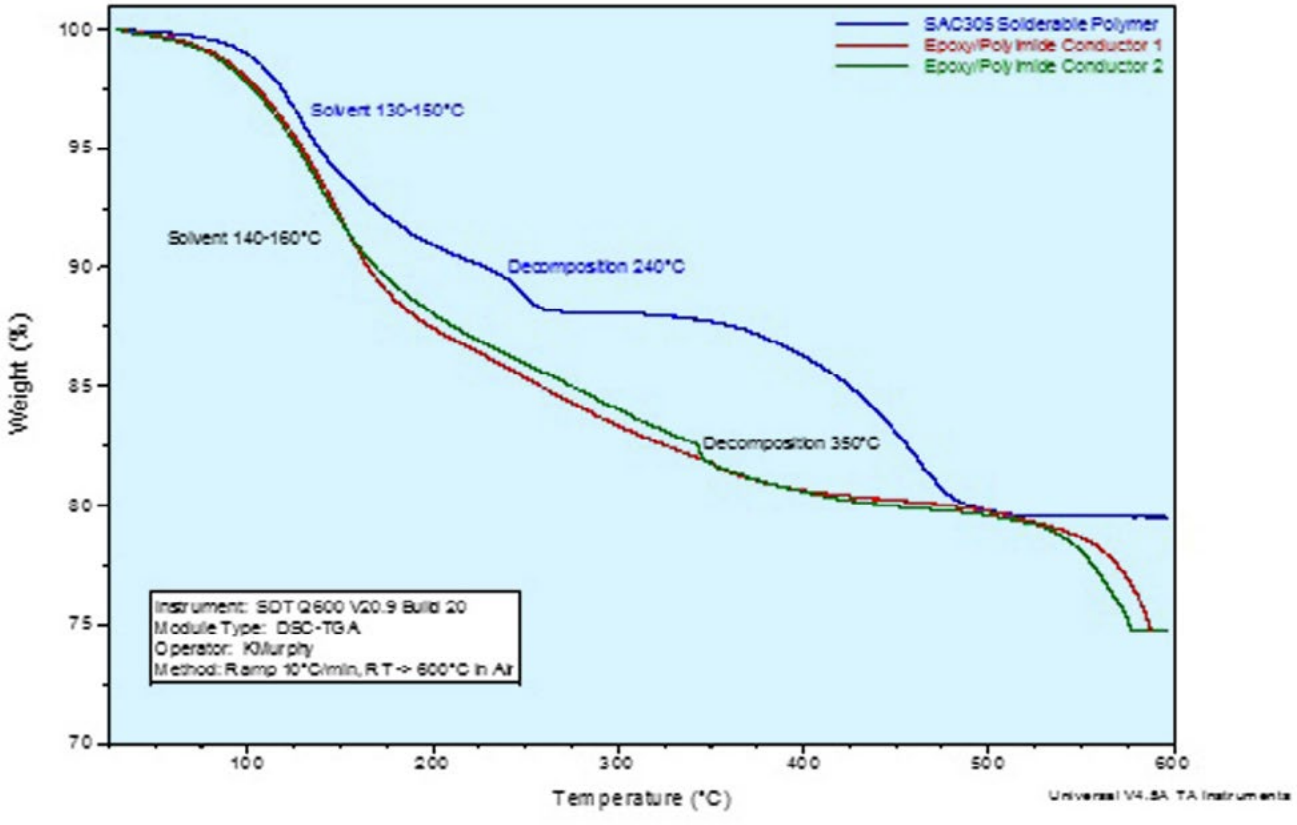


Figure 2: A comparison of the solderable silver conductor with two additional silver conductors utilizing different resin systems.

has begun to decompose. The TGA will reveal the decomposition temperature that correlates to the maximum cure temperature of the paste. Figure 2 shows a comparison of the solderable silver conductor with two additional silver conductors utilizing different resin systems. The curing temperatures established for the testing of this system were set at 150°C and 200°C.

The polymer paste was initially designed for operation on FR-4, alumina, and aluminum (with a polymer insulating layer). It was printed onto all substrates with a 280-mesh screen and cured at either 150°C or 200°C in a forced-air convection oven. The paste was printed to a wet thickness of 38–42 µm with a resulting cured thickness of 23–27 µm.

All parts considered for reliability data were hand soldered with SAC305 solder using 615 RMA flux. Adhesion was performed by attaching solder-plated copper (60/40) tin/lead leads to 80 x 80 mil pads at a 90°angle to the substrate.

The polymer paste was built up in a variety of thicknesses to examine the correlation of cured film thickness and spreading. Table 1 shows the spreading of the 1600 mil² pads with up to five layers of paste on both FR-4 and alumina substrates. Spreading is apparent and has a direct correlation to the thickness of the conductor paste. Decreasing the level of spreading is under further evaluation.

Conductivity Requirements

One of the most challenging obstacles to overcome when working with a thick film polymer conductor is the conductivity requirements. The usual resistivity of a silver thick film

SAC305 Solderable Polymer	1 Layer	2 Layers	3 Layers	4 Layers	5 Layers
FR4	1830 mil²	1858 mil²	1860 mil²	2067 mil²	2153 mil²
Alumina	1770 mil²	2104 mil²	2153 mil²	2104 mil²	2150 mil²

Table 1: Spreading of multiple layers of polymer paste.

Substrate	FR4	Alumina	Aluminum with Silcone Dielectric	Aluminum with Phenolic/ Epoxy Dielectric
Curing Conditions	150°C for 30 minutes			
Resistivity (mΩ/sq/mil)	26.90	30.44	24.75	26.19
Curing Conditions	200°C for 30 minutes			
Resistivity (mΩ/sq/mil)	23.03	19.72	20.18	18.42

Table 2: Resistivity of the polymer pastes.

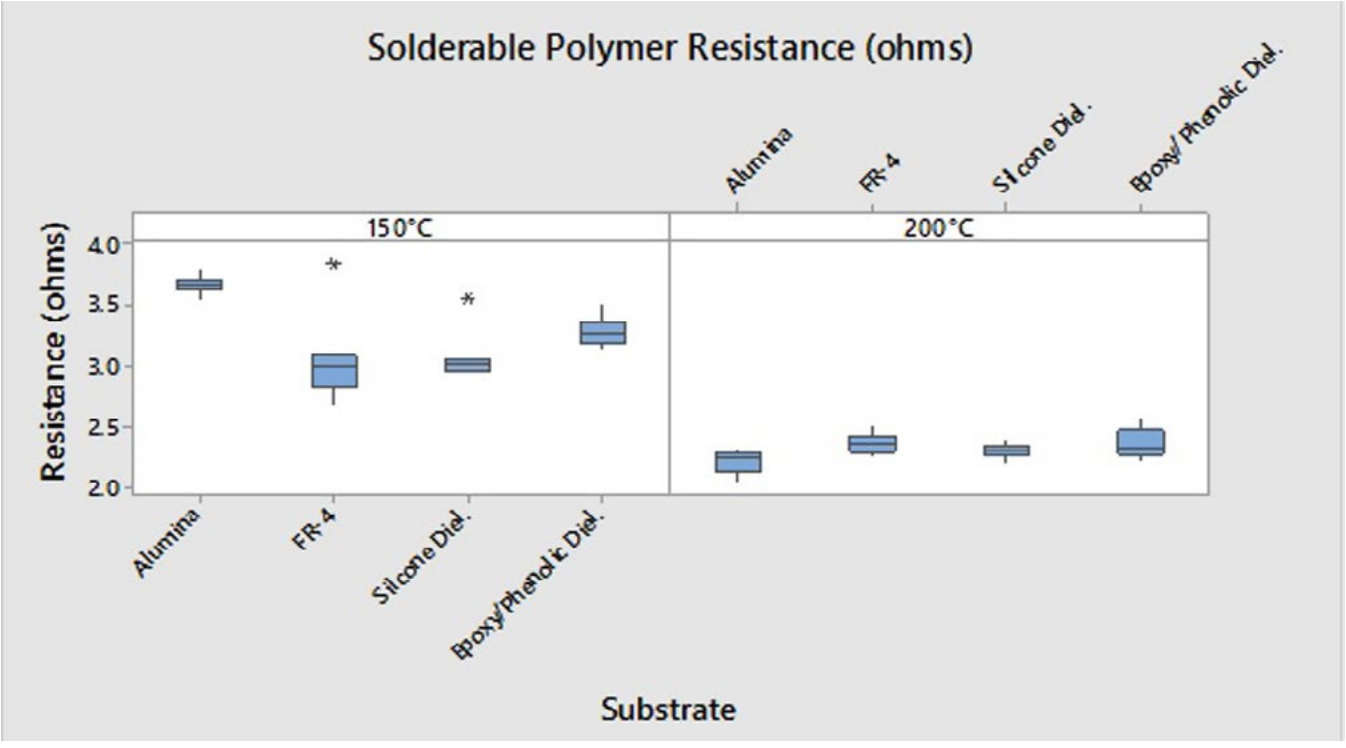


Figure 3: Boxplot of polymer paste resistance. The spread of the resistance values are shown between the two cure temperatures of 150°C and 200°C.

conductor is 3mΩ/sq (when normalized at 12 µm). The polymers within the thick film polymer conductors do not burn off as traditional organics in a typical thick film material.

While these remaining organics are important to the physical properties of the material, creating adhesion and impacting rheology, they can create gaps in the point-to-point contact of the silver particles. This interruption of contact increases the resistivity of the polymer conductor. Table 2 shows the resistivity of the polymer paste when processed on a variety of substrates evaluated during testing.

By increasing the curing temperature, more desirable conductivity results may be achieved. Curing at higher temperatures tends to decrease the level of polymer in the cured film. A proper curing is critical to finding a balance for the most desired properties of the cured film. Figure 3 shows the difference in resistance when the polymer paste is cured at 150°C and 200°C. A considerable difference is noticed in the level and spread of resistance values at different curing temperatures.

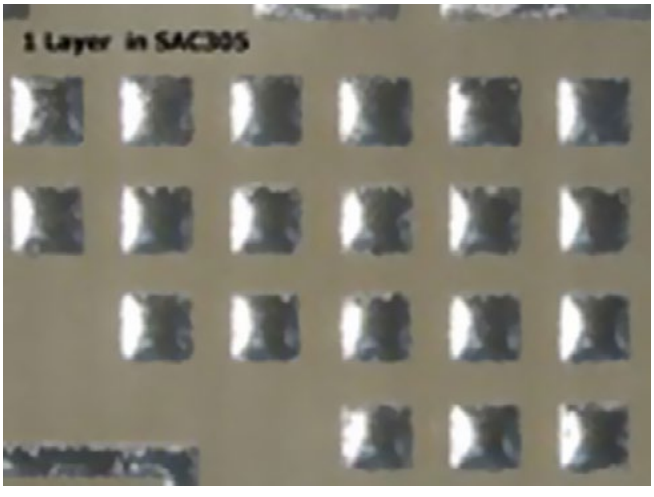


Figure 4: The polymer paste with SAC305 solder on FR-4.

Polymer Paste Solderability

SAC305 (96.5Sn3Ag0.5Cu) solder was chosen for this soldering process due to its popularity in the market as a replacement for Sn63 alloys. The high melting temperature of SAC305 poses many challenges in the de-

velopment of a low-curing, solder-accepting polymer paste.

The cure temperature of the polymer paste is typically ≥50°C below the suggested reflow temperature of the SAC305 solder alloy. The melting point of SAC305 is between 217°C–219°C. For the test procedures, the solder pot temperature was set to 235°C–250°C depending on the substrate choice.

The polymer paste was originally designed to be solderable using SAC305 solder with 615 RMA flux. Solderability was determined by observing 40 x 40 mil pads after a dip-soldering method of five seconds. Figure 4 shows the initial solderability testing of the polymer paste on FR-4 with SAC305 at 235°C. After confirming solderability with SAC305, other Pb and Pb-free solders were tested.

Included in the additional testing, the other solder choices were: 62Sn2Ag36Pb (Sn62), 10Sn2Ag88Pb (10/88/2) and 95Sn5Ag (95/5). All solders were tested in the same method as described above, with the exception of temperature (Figure 5). Figure 5 shows the wettability of the different solders on the polymer paste when printed on FR-4 substrates.

For the remainder of the substrates tested, soldering was performed with SAC305 solder and 615 RMA flux. Solderability was performed on all substrates cured at both 150°C and 200°C.

The solderability of all substrates considered in this experiment is shown in Figure 6.

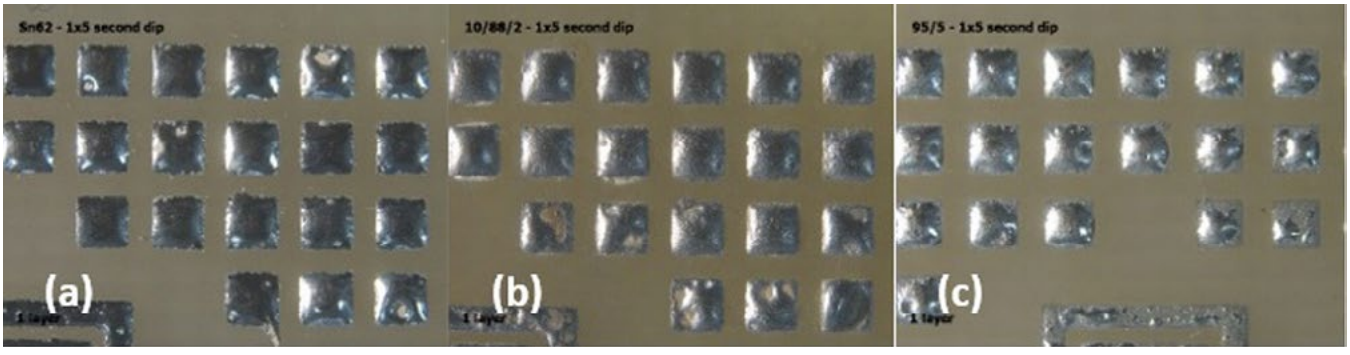


Figure 5: Solderability of the polymer paste with different alloys: (a) Sn62 at 230°C; (b) 10/88/2 at 330°C; (c) 95/5 at 270°C.

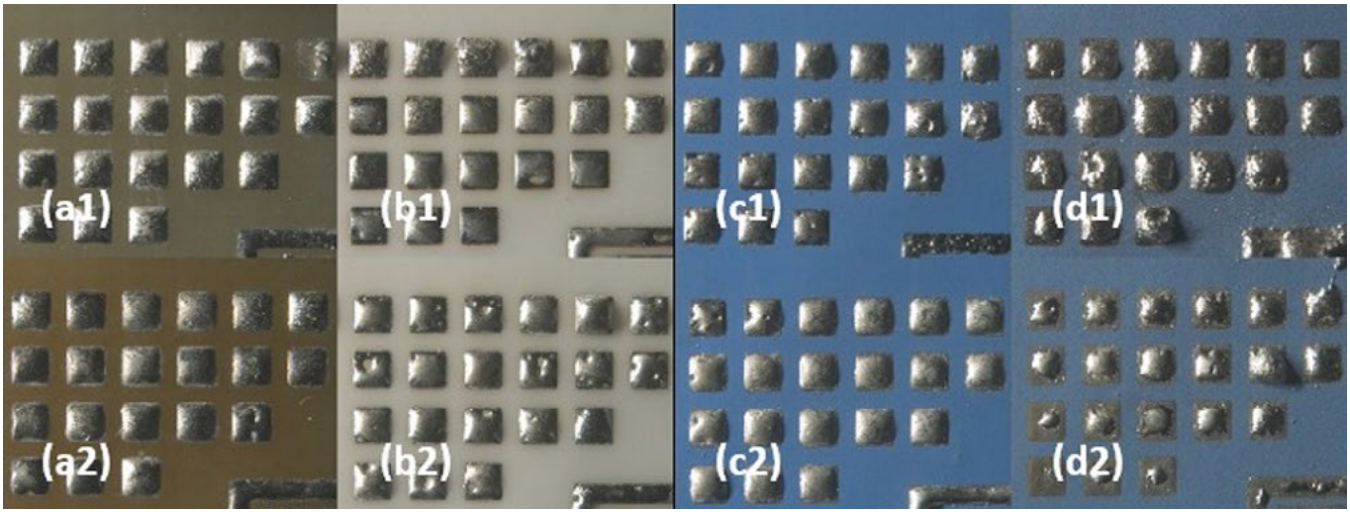


Figure 6: Solderability of the polymer paste on various substrates: (a) FR-4; (b) alumina; (c) silicone dielectric on aluminum; (d) epoxy/polyimide dielectric on aluminum. Note: The pictures labeled "1" represent a 150°C curing and the pictures labeled "2" represent a 200°C curing.

When soldering the aluminum substrates, the solder pot temperature required an increase due to the increased mass of the substrates along with the high thermal conductivity of the aluminum. The rapid cooling experienced due to these substrate properties caused SAC305 to leave an excess amount of solder on the substrate. For all solderability parts on aluminum, the temperature of the solder pot was set to 250°C. The alumina substrates were soldered at the same temperature as the FR-4 samples (235°C).

Adhesion Characteristics

When considering a thick film for an application, the conductor's durability is a priority. Many thick film build-ups have to operate unchanged for thousands of hours. Polymer conductor pastes are typically used in consumer products which are replaced on a regular schedule. They do not have the same requirements as high-temperature thick film materials used in applications such as military or automotive. Even though the use of these materials is different, they still need to be durable under the same requirements. After testing the initial adhesion of the polymer paste, three aging techniques were also observed: 125°C thermal aging, 85°C/85% RH and thermal cycling (-55°C–150°C).

The results of all aging data show a polymer conductor that will be durable on a number of substrates through various aging conditions. These results are especially promising on FR4, where adhesion has remained relatively unchanged through all aging tests.

Low-Temperature Pastes

There are many circumstances that are leading to an increased interest in low-temperature substrates and low-temperature processing, including new technologies in the electronics market, along with the rise in processing costs for high-temperature materials. Due to these changes in the industry, manufacturers are seeking alternatives to traditional thick film pastes. To meet these demands, polymer systems are being developed that can withstand the testing and processing of cermet systems.

Test results have proven the availability of a solderable conductor with good conductivity and high adhesion. The adhesion results are particularly high for FR-4 applications; however, good results are also seen with other substrate materials. These results show that there are new low- temperature alternatives that fit within the new demands of the electronics market. The polymer paste not only meets the industry demands of a Pb-free soldering polymer, but also fulfills the global requirements of RoHS- and REACH-compliancy. **SMT**

Steven Grabey is a research engineer at Heraeus Electronics.

Tandem Solar Cells are Simply Better

Researchers under Stephan Buecheler and Ayodhya N. Tiwari from the Laboratory for Thin Films and Photovoltaics at Empa-Swiss Federal Laboratories for Material Science and Technology have come up with a procedure that makes it possible to produce thin film tandem solar cells. The methods are suitable for large area, low cost processing. Flexible plastic or metal foils could also be used as substrate in future. This marks a major milestone on the path to mass production of high-efficiency solar cells with low cost processes.

The researchers create the top solar cell perovskite film with a low-temperature procedure at just 50°C. This promises an energy-saving and cost-saving production stage for future manufacturing processes. The tandem solar cell yielded an efficiency rate of 20.5% when converting light to electricity. Already with this first attempt, Empa researchers have emphasized that it has lots more potential to offer for better conversion of solar spectrum into electricity.

SMT QUICK TIPS

Selecting a Wave Soldering System, Part 2

by Robert Voigt
DDM NOVASTAR

In the last column, we introduced the various types of through-hole (or thru-hole) soldering techniques, which include:

1. Manual
2. Dip
3. Drag
4. Wave
5. Selective

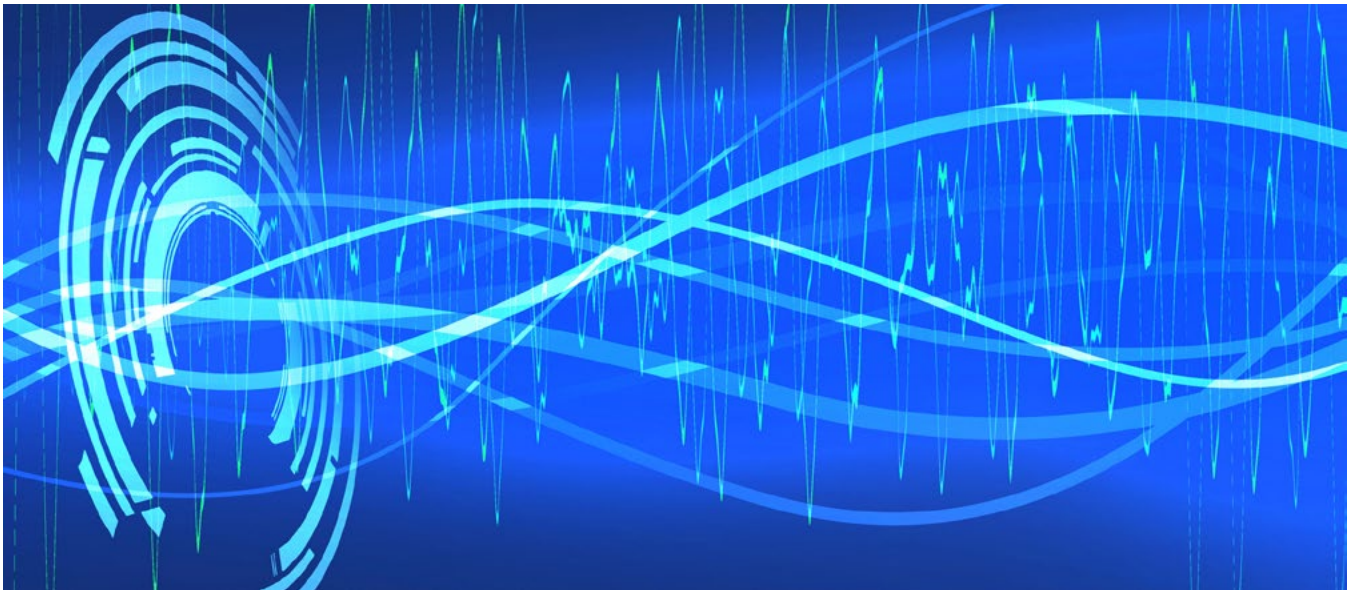
While manual soldering is still in practice today, it is usually not found in a production environment because it involves highly skilled and labor intensive work producing very low numbers of boards. Dip and drag were introduced many years ago as lower cost alternatives to wave soldering, but have become outdated forms with the advent of more affordable and highly accurate wave systems.

Today, wave soldering is the most common and most efficient form of through-hole soldering available. It involves a solder pot large enough to handle the width of the largest boards you expect to process. By pumping hot solder through a nozzle in a way that the bottom of the board surface encounters the wave caused by the nozzle, the resultant hot solder waterfall creates a single point of contact across all the connection joints on the board, eliminating any potential bridging. The system usually integrates a fluxing station, a pre-heat station, and a wave station in a conveyorized system, using fingers or pallet-type board mounts.

Wave soldering is a time-tested technique, but there are many variations of systems to look for depending on your needs. In all of them, three operations are involved:

1. Applying the flux
2. Applying pre-heat to activate the flux
3. Applying solder

The first step in selecting a wave system is to identify the largest board size (length x width) the machine will be expected to process. This will determine the machine size and, just as im-



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SELECTING A WAVE SOLDERING SYSTEM, PART 2

Figure 1: Turbulent wave (left) and laminar wave (right) in same system.

portantly, its cost, from a benchtop unit handling 8" boards (starting in the $10,000 range), up to free-standing machines with capacities up to 24" using a very large solder pot (costing as much as $80,000 or more). The larger sizes will also accommodate much more solder, which also contributes to the cost of ownership.

A larger system provides greater flexibility. It can not only handle larger boards, but it can also handle multiple smaller boards conveyed side-by-side to increase throughput. A prospective buyer may consider production throughput by calculating number of boards through a total cycle time from start to finish varying from 2.5–4 minutes from flux to solder.

Features of wave solder

There are two types of wave:

• **Laminar** wave produces a very smooth laminar flow of solder much like a waterfall. This is the most widely used type.

• **Turbulent** wave sends solder up into the board with a highly turbulent wave used for thru-hole components such as pins with long legs that are fairly closely positioned, and for denser components. The turbulent wave helps to wick off (pull solder from the component's stem into the component joint) excess solder to reduce icicles or bridging.

Some machines are available with dual pots that can be used independently or together on the same board. SMD components are often processed in a turbulent wave machine.

How a wave system works

Based on the machine's control system, a wave is created by a high pressure chamber pushing solder out through the solder nozzle. A chamber holds the nozzle, pump motor that drives an impeller inside the pressure chamber.

The conveyor that holds the board attacks the wave at a 7° angle, and makes contact on

Figure 2: Benchtop wave solder system.

all components only for a very short time, then exits the wave.

The solder pot size is determined by wave size, the smallest holding around 100 lbs. of solder for a 7–8" wave width, up to 2,400 lbs. of solder for a 24" wide wave. Since solder is costly, the size of the machine contributes to the cost of operation. Also, solder running in a hot wave is susceptible to oxidation and depletion so all these factors add cost. Inerting the area with nitrogen at the point of contact will produce a better quality joint and eliminate the possibility of a cold solder joint or oxidation. Nitrogen also helps to cut down on dross, which is defined as solder that builds up enough oxidation or flux residue to render the solder useless, somewhat like slag.

Contact on the component by the solder wave only takes place in seconds and once passed, cools almost immediately.

Flux systems

There are two common types of fluxing systems are available:

• **Foam:** A bath or pot that is usually as wide as the wave. The flux is poured into the flux pot, and an aerator in the pot creates foam which is applied to the thru-hole component and board.

Figure 3: Foam fluxer.

• **Spray:** A high pressure container holds flux which is sprayed on the board by an oscillating spray head to cover all the components and the entire board.

Foam fluxing tends to be less expensive and easier to maintain than spray. The downside is that this will cause evaporation if it's not contained, and the flux will degrade more quickly. Foam systems are low cost to operate, and easy to use and maintain.

SELECTING A WAVE SOLDERING SYSTEM, PART 2

Figure 4: Spray fluxer.

Spray flux is contained in a high-pressure chamber which eliminates evaporation or degradation. However, spray systems are much more expensive, they're difficult to set up, and require daily maintenance. They also involve a higher learning curve because it needs to be customized for each different board configuration.

Preheat systems

Flux requires activation by heating, so any wave system requires a preheat station enclosed in a conveyorized chamber, where preheat temperatures reach 140°C–175°C. Both the components and the board are pre-heated to eliminate thermal shock during the wave.

Figure 5: Example of preheaters in a wave solder system.

Typical preheat technologies are:

- Infrared (IR), which produces very robust heat
- Convection, which applies more even heating

Many preheaters are available with a combination. Convection is typically used in a no-clean flux environment, which provides a dry surface and eliminates post-solder cleaning. There are many variables in every system, so it's very important to discuss your needs with a vendor partner to determine what's best for your situation.

Check References

Remember to consult a variety of machine providers, talk to the manufacturers themselves if possible, and get references to contact before making a purchase. An important consideration for a complex machine such as a wave soldering system is factory support, specifically training, software, upgrades and spare parts.

Next time: Board handling methods. **SMT**

Robert Voigt is VP of global sales at DDM Novastar Inc. To reach Voigt, click here.

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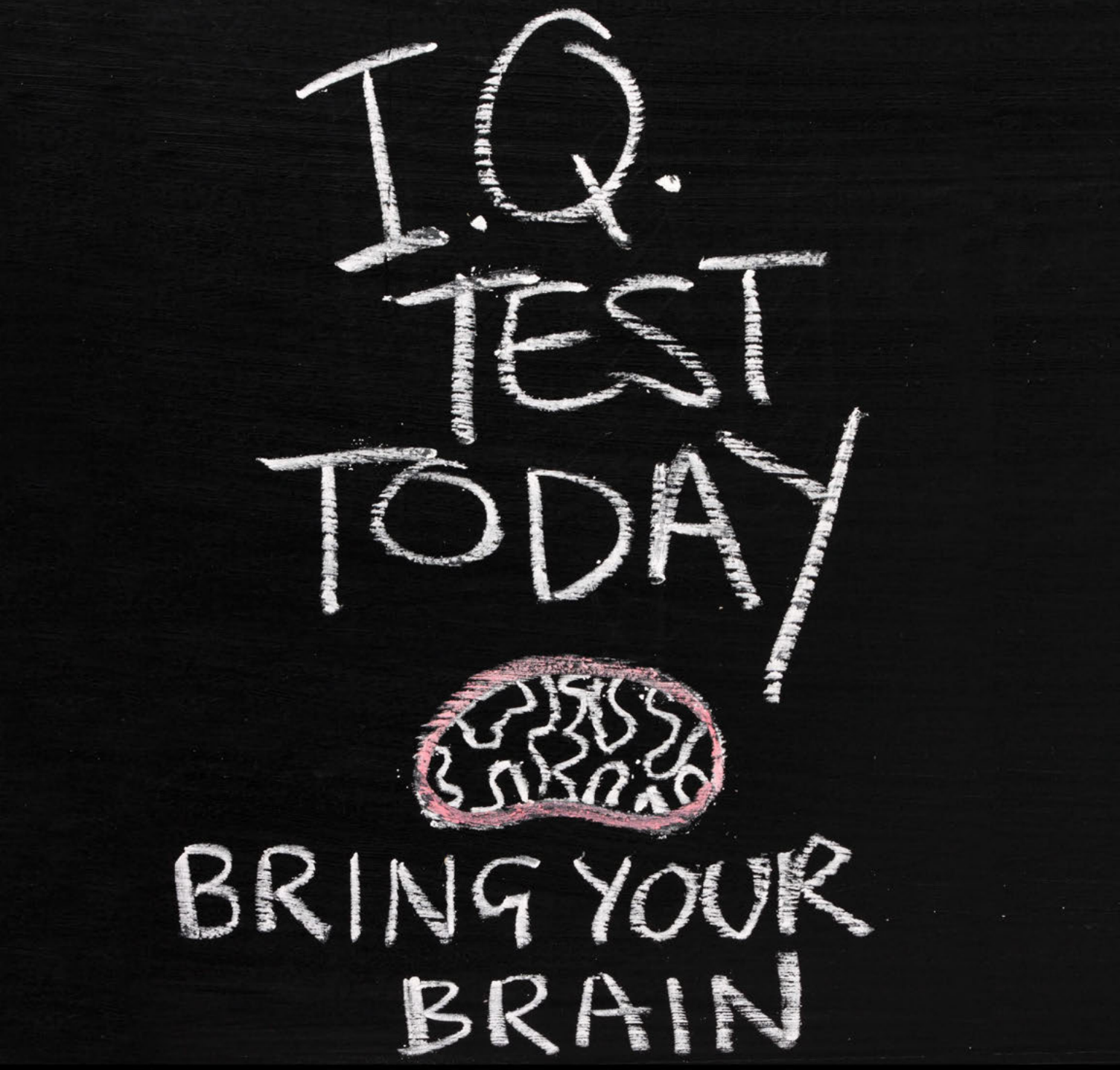

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EMS PROVIDERS:
Maintaining Competitiveness and Seeking Significance

by Frederick Blancas
INTEGRATED MICRO-ELECTRONICS INC.

The EMS industry faces myriad difficulties. Looking at the latest figures of New Venture Research, a market research firm covering electronics manufacturing, the global EMS industry is anticipated to grow a mere 6.4% compounded annual growth rate (CAGR) from US$336 billion in 2014 to US$458 billion in 2019. Gone are the times when the industry used to post double-digit growth rates.

The total electronics assembly market, on the other hand, is expected to grow at 6% CAGR from US$1.26 billion in 2014 to US$1.68 billion in 2019. The EMS industry has a slightly better growth rate projection.

The total electronics assembly outsourced by the OEMs in 2014 to EMS providers and original design manufacturers (ODMs) accounted for 34.4% of the value of the total electronics assembly. This small piece of the pie for the electronics outsourcing segments will likely grow minimally to 34.9% in 2019. The OEMs still comprise the bulk of electronics manufacturing.

In a very dynamic business environment, the fate of the industry is marked by the yin and yang forces of challenges and opportunities.

Sluggish Economy

The global economy is not yet out of the woods. The October 2015 IMF *World Economic Outlook* report states, "Prospects across the main countries and regions remain uneven. Relative to last year, the recovery in advanced economies is expected to pick up slightly, while activity in emerging market and developing economies is projected to slow for the fifth year in a row, primarily reflecting weaker prospects for some large emerging market economies and oil-exporting countries."

The recovery is expected to continue in the U.S. and Euro zone but the growth outlook is very modest. The U.S. economy is expected to grow by 2.6% year-on-year this year and 2.8% next year versus last year's 2.4%. The Euro zone economy is likely to grow slightly by 1.5% this year and 1.6% in 2016 from last year's 0.9%.

Japan is likely posting 0.6% growth rate in 2015 due mainly to weak exports to China and the U.S., coupled with poor consumer spending.

The growth in China will likely slowdown to 6.8% this year and 6.3% next year—faster compared to other economies' growth rates but not as fast as its 7.3% last year. China's weakness is due to a large extent to overcapacity in

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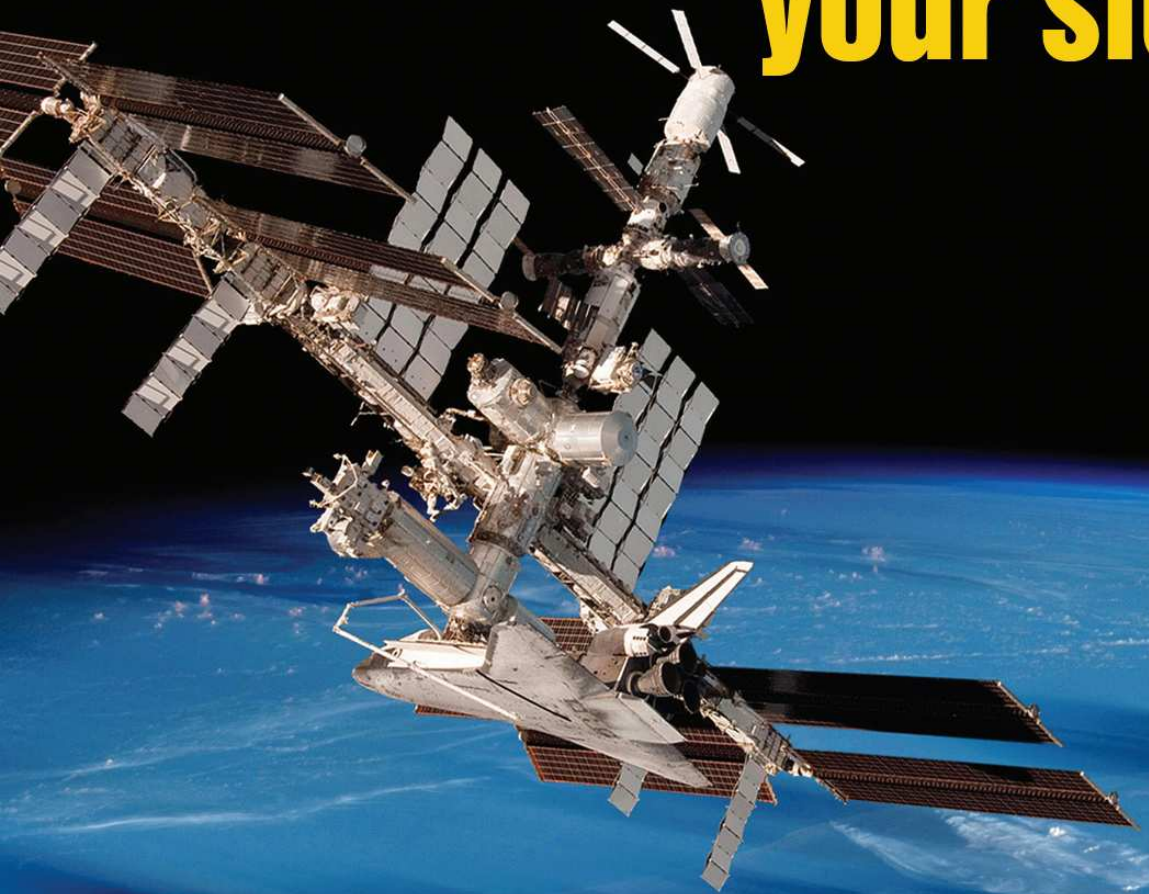

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traditional industries, moderate growth of investment, and weak export sector.

Industry Downturn

The global electronics industry is experiencing a downturn. The world of personal computers takes a beating. Global PC shipments totaled 73.7 million units in the third quarter of 2015, a 7.7% decline from the same period last year, according to Gartner, Inc.

The market is expected to reach about 300 million units in 2015, a decline of 4.5% year over year. "We do not expect the global PC market to recover until 2016," said Ranjit Atwal, research director at Gartner.

In a recently published report from the Dell'Oro Group, the worldwide telecommunication network infrastructure capex fell nearly US$10 billion in dollar terms in the first half of 2015.

> "The huge population of Asia and its expanding middle class augur well for premium goods like high-tech products."

In China, the 4G rollout has reached its projected volume and 5G deployment will likely commence by 2017 at the earliest.

Silver Lining

Amid all these challenges, hope floats. The largest economies that matter for electronics consumption—The U.S., China, Germany, France, Japan, and ASEAN—continue to expand albeit either slowing down or posting minimal growth. While the Chinese economy is slowing down, bold reforms by the Chinese government are being implemented. Thus the economic weakness will probably be short-lived.

The huge population of Asia and its expanding middle class augur well for premium goods like high-tech products. According to a recent Nielsen study, the middle class population in Asia will balloon to 3 billion by 2030. This will account for about 80% of the global middle class.

The growing aging population in the developed countries, on the other hand, presents new opportunities for telemedicine and medical electronics.

Urbanization is on the rise. KPMG predicted that by 2030, 60% of the world's population will live in cities. This brings about opportunities for smart cities to enhance the quality of their people's lives.

Smart cities have deployed the integration of information, communications and technology (ICT) solutions across three or more different functional areas of a city. The main function areas typically include mobile and transport, energy and sustainability, physical infrastructure, governance, and safety and security.

The car is becoming more of an electronic equipment. Today the electronics' share of vehicle value is at 40% for traditional, internal combustion engine cars. This percentage value will definitely rise in the next few years.

A promising area is the advanced driver assistance systems (ADAS) market which generated about $27 billion revenues in 2014 and expected to grow at CAGR of 14.9% to reach $78 billion by 2020 according to ARC.

Part of the ADAS market is the automotive camera submarket. Its revenues totaled US$1.2 billion in 2014, and will continue growing at 36% CAGR until 2020 per Yole Development. The automotive camera will shift from an add-on car feature to a must-have equipment due to regulations in the U.S. and the European Union. It is a key building block of the next-generation ADAS for the driverless car.

Maintaining Competitiveness

To address the market uncertainty and volatility, EMS providers have diversified the markets they serve to balance enterprise risk among sources of revenues, garner higher profit margins, and maintain competitiveness.

As the margin for the traditional markets of the 3Cs (computing, communications, and consumer electronics) continues to narrow, EMS providers are intensifying their play in nontraditional markets like automotive, indus-

trial, and medical electronics.

Analyzing the revenue breakdown per market segment for 38 of the top 50 EMS providers in the world, the nontraditional segments (automotive, industrial, medical, military, and avionics) increased from to 45% in 2014 from 34% in 2013.

Integrated Micro-Electronics Inc. (IMI), for example, has grown its business in the automotive, industrial, and medical electronics sectors, diversifying from the highly uncertain niche of storage devices and competitive space of consumer electronics. It is among the top EMS players in the automotive space.

"There's a conscious collective effort within IMI to grow our automotive business. Global teams with the right automotive quality mindset support each other to make it happen," IMI president and CEO Arthur Tan said. "We've beefed up our technical expertise and developed our own technology platforms like our automotive camera platforms. Also, we maintain strong partnerships with the leading Tier 1 suppliers."

EMS providers have also diversified the activities that they engage in, attempting to move away from the low single-digit profit margins usually generated by PCBA and box build.

Component manufacturing is one area many EMS venture into. Eric Miscoll of Charlie Barnhart & Associates LLC said that fabrication (metal and plastics) and harness manufacturing (copper and fiber optic) services account for roughly 10% of EMS revenues globally.

Foxconn, the top EMS provider in the world, leads the industry in venturing into component manufacturing. It is successful in leveraging its expertise for mechanical and electrical parts to provide the lowest total cost solutions, resulting in affordable electronic products for people all over the world.

Sanmina designs and manufactures plastics for a variety of applications that include medical and industrial products. It is also engaged in the manufacture, mechanical and thermal design of indoor and outdoor enclosures for communications networks, medical, and industrial products.

Further, Sanmina provides design and fabrication of advanced optical and RF microwave modules as well as precision machined components and assemblies. Its Viking Technology makes solid state disk and DRAM products for a variety of high-performance computing, storage and industrial applications.

There are EMS providers who have ventured into their own products. A good example is Sparton Corp. It is an industry leader in sonobuoy—a tactical sonar system for transmitting submarine activity used for anti-submarine warfare. Sparton's product strategy, along with the quality of its management, helped save company.

The sky is the limit when it comes to how EMS providers have diversified. We have seen diversification into higher-margin electronics markets, into adjacent markets, into new territories, and into original product manufacturing. It will not be surprising if they will also diversify into non-electronics manufacturing.

Seeking Responsibility and Significance

EMS providers have gone into green manufacturing. For instance, they have implemented RoHS compliance, lead-free program in response to concerns about the environmental impact of lead and other hazardous substances in the manufacture of electronic products.

Building a lead-free product goes beyond taking out lead in the materials used. It means that an EMS provider is able to re-profile an entire manufacturing process to ensure that it still meets the reliability requirements of building an electronic product, but at the same time taking out the hazardous elements.

There is the Dodd-Frank Consumer Protection Act that addresses the trade and use of conflict minerals—raw materials used in electronics production (gold, tungsten, tin, and tantalum) that come from Congo, where conflict is occurring. Since 1996, more than 5,000,000 people have died as a result of warfare and struggles for that country's wealth of resources.

The act requires public declarations, prompting EMS providers to change or reconsider their sourcing policies and supply chains.

There is more than just green manufacturing initiatives that EMS providers do as they try to embed sustainability in their strategy and operations. This is not widespread yet in the industry but with the identification by the United Nations of its 17 sustainable development goals, the sustainability initiatives of EMS providers take on depth and increased significance.

Beyond philanthropy and corporate social responsibility, EMS providers have begun to tread the path to shared value creation for their stakeholders. With the 3Ps of profit, people, and planet in mind, EMS providers try to meld profit and purpose. They start consciously adding to their portfolio programs or businesses that are innovative and profitable that address social or environmental issues.

The business of Flextronics already includes products related to renewable energy (assembly of solar modules and solar power inverters), energy efficiency (smart meters and LED lighting solutions) and efficient power conversion and storage (high density batteries and power supplies and wireless charging). Its agreement with NEXTracker, a leader in smart solar tracking solutions, will expand Flextronics' solar capabilities in commercializing smart and connected energy technologies.

Further, Flextronics, through the Flex Innovation Labs (in Silicon Valley) nurture innovative companies and smart technologies in a state-of-the-art technology development environment. Leveraging Flextronics' advanced design and manufacturing expertise, technology startups gain access to one of the world's largest hardware ecosystems.

IMI has embarked on the development and manufacture of automotive cameras and other car safety products to help in the prevention of road accidents or lessen the impact of accidents if they occur. It also assembles security and access control devices for human and property protection from theft and other crimes, dosimeters that measure exposure to ionizing radiation for human radiation protection, and medical diagnostic devices for detecting illnesses.

There's more that EMS providers can do. Medtronic, which is not an EMS provider, can inspire EMS companies on what else they can do. It was recently recognized as one of the world's leading companies for sustainability with its ranking on the Dow Jones Sustainability North America Index for the eighth consecutive year.

Medtronic's commitment to sustainability centers on creating value through the provision of a global access to healthcare. "We are proud of our efforts to address chronic disease, to follow environmentally sound business practices, and to bring sustainable value to all of our stakeholders," said Gary Ellis, Medtronic's chief financial officer.

For example, Medtronic partnered with Apollo Hospitals in India to address end-stage renal disease for patients who need renal replacement therapy. It aims to bring an affordable and portable hemodialysis system to market in the region, where about 10 percent of adults are affected by chronic kidney disease.

As we in the EMS industry seek significance and responsibility, I wish that we ask ourselves: What is it that we've done to make this world a better place. I wish we would be guided by the golden rule: Good begets good. It is a virtuous cycle after all. Our businesses or initiatives that address the societal issues could result in improvements in people's lives as well as the protection of the environment. These affect our businesses positively, creating profits that we can use to sustain our activities and do more good. **SMT**

Frederick Blancas is a senior division manager at Integrated Micro-Electronics Inc. (IMI).

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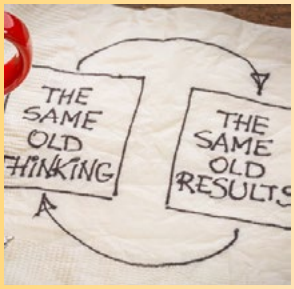
Pete's TOP TEN SMT Articles for 2015

1 The SMT Internet of Things—Back to Basics

Different people have different understandings and expectations about what the Internet of Things (IoT) actually is, especially with respect to how it could work and what it could bring to the SMT assembly industry. There are a lot of expectations to fulfil as principles behind innovations such as Industry 4.0 take hold.

2 Declaring War on Failure in Electronics



Failure, in electronics, while not necessarily desired by either manufacturer or consumer, is expected. This is not to say that the industry has not attempted to improve reliability. In this article, Verdant Electronics' Joseph Fjelstad writes that much is being done in an effort to improve reliability with new solder alloys, new fluxes, new materials, new equipment and process parameters.

3 The Rise of Structural Electronics

Structural electronics is one of the most important technological developments of this century. It forms a key part of the dream, first formulated 30 years ago, of computing disappearing into the fabric of society. It also addresses, in a particularly elegant manner, the dream of Edison in 1880 that electricity should be made where it is needed.

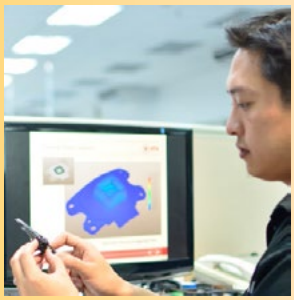
4 Time to Ditch Heavy Metal for Soft Rock?

Yash Sutariya and Thomas S. Tarter shine a light on the often overlooked topic when it comes to PCBs for LEDs: reliability. They wrote that composite materials can provide both a thermal management solution and a dimensional stability solution that has not yet been presented through conventional materials.

5 Cutting Cost, Not Price

In any supply chain survey, the issue of cost comes up repeatedly. This article explores the downside of focussing on price and suggests some of the practical ways you can reduce costs without having a negative impact on your product.

6 Automotive EMS—Going Beyond Assembly



The trend toward outsourcing in the automotive industry continues as automotive manufacturers strive to capitalize on the technical expertise and cost effectiveness of the EMS providers. For their part, the automotive EMS players have expanded their role through vertical integration and venture into the realm of non-electronics manufacturing.

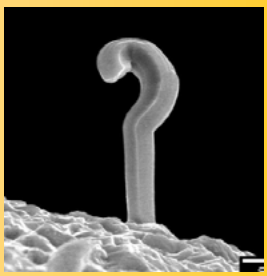
7 Value Stream Mapping—Operationalizing Lean Manufacturing

By applying value stream mapping (VSM), EMS providers can have a clearer picture of multiple processes involved in a work flow, identify waste and its sources, identify where change is required, standardize the process, and identify potential problems that could be encountered in the future state. It can also be used as a tool for planning as well as for managing changes.

8 Jetting Strategies for mBGAs—A Question of Give and Take

Among the alternatives for the deposition of solder paste and other fluids on a PCB is jetting, which offers advantages concerning precise volume repeatability, software control and local volume control. The goal of this study is to examine the effect of piezo actuation profile on deposit quality with respect to positioning, shape and satellite levels in order to achieve adequate deposition quality for applications such as 0.4 mm BGA.

9 The Unpredictability of Tin Whiskers Endures



Into decade number two of the European Union's RoHS and REACH restrictions for the use of lead in electronic components, the risk of tin whiskers in critical circuitry continues. This article will explore a tin whisker mitigation process for surface mount electronic components applicable to both passive and active components.

10 Enclosed Media Printing as an Alternative to Metal Blades

The evolution of PCBs in terms of the miniaturization of assemblies, components, and ever-finer feature print patterns has not slowed, and as a result continues to present ever-increasing challenges to the makers of assembly equipment and solder paste printing technology, narrowing the process window. In this article, Michael L. Martel discusses how enclosed media print head technology has kept up to these challenges.

EVENTS

For the IPC's Calendar of Events, click here.

For the SMTA Calendar of Events, click here.

For the iNEMI Calendar, click here.

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2015 International Printed Circuit & APEX South China Fair
December 2–4, 2015
Shenzhen, China

Implementing Photonic Integration
December 6–8, 2015
Cambridge, Massachusetts, USA

Pan Pacific Microelectronics Symposium 2016
January 25–28, 2016
Big Island, Hawaii, USA

Rocky Mountain Expo & Tech Forum
January 26, 2016
Denver, Colorado, USA

Houston Expo & Tech Forum
March 1, 2016
Stafford, Texas, USA

Dallas Expo & Tech Forum
March 3, 2016
Plano, Texas, USA

IPC APEX EXPO Conference & Exhibition 2016
March 15–17, 2016
Las Vegas, Nevada, USA

CPCA Show (China International PCB & Assembly Show)
March 15–17, 2016
Shanghai, China

South East Asia Technical Training Conference on Electronics Assembly Technologies 2016
April 12–14, 2016
Penang, Malaysia

NEPCON China
April 26–28, 2016
Shanghai, China

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