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UYEMURA INTERNATIONAL CORPORATION

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Backplane Industry Finds Immersion Tin is Cleaner, Flatter, and 3x Faster – and Ideally Suited for Press Fit Connectors

Two years ago, a Uyemura ENIG customer complained about the "inferior tin" it was getting from another supplier. Ionic cleanliness and aesthetics were the main issues; because components were press fit, surface integrity was critical.

Using as its basis a final finish with a long, successful history, the Uyemura Laboratory developed, over the course of 18 months, a highly differentiated process that solved the customer's board cleanliness and appearance issues, and provided other performance enhancements.

RMK-25, Uyemura's flagship in immersion tin, was proven capable of extraordinary process versatility – versatility that allowed it to consistently operate 3X faster than the competitive average. When run in parallel, it was substantially more productive than the customer's process of record. Most notably, this evolved product, with its unique crystalline structure, produces a flat microstructure with excellent aesthetics and thickness uniformity - and minimal copper etchback.

Backplane assembly frequently uses press-fit connectors, but recent designs are incorporating multiple reflow operations into the assembly process. Uyemura has created a highly solderable finish, which is a huge advantage for many complex new designs. Crystalline structure and deposit uniformity assure that even with multiple soldering operations, solder integrity holds over the long term. Similarly, the preferred crystalline structure deposits uniformly over the lifetime of the bath.

> This maybe the ultimate story of a well-established finish being reengineered and enhanced to meet new requirements.

With the industry under intense price pressure, differentiation is king. We believe customers today face two big challenges. The first is commoditization; the second is expectations that boards must do more than ever before. Uyemura's newly evolved (and now highly documented) immersion tin provides high-value advantages that are unique in the marketplace – advantages that will help customers meet both challenges head-on. *(for RMK-25 attribute chart see pg. 4)*

RMK-25 At-a-Glance

- Up to 100% increase in line capacity and productivity
- Board cleanliness capability at 40% below IPC specification
- Deposit thickness control at 1.5 standard deviation from the mean
- Preferred solderability and wetting time
- Minimal copper attack and undercut

A Sincere "Thanks"

Don Walsh
Director of Operations

For 167 years, Uyemura has been a company distinguished by strong ethical standards, world-class innovation, and exceptional people. Our founders would certainly be proud of our incredible accomplishments. I'm equally certain that they would have as much optimism about the next century as I do.

With 2012 now far in the rear view mirror, there are many things we can be grateful for. At the top of this list is a truly extraordinary year that saw our market share for both ENIG and ENEPIG expand beyond our highest expectations. We worked hard to assure that each customer gained maximum value from these, and all of our processes. We were also delighted that our Immersion Tin Project concluded with such excellent results (see pg. 1) and that our Tin Whiskers technology is poised to solve an issue that has plagued the electronics industry since its inception.

I would be remiss if I did not also thank our Uyemura associates, whose deep knowledge, and "extra-mile" dedication have allowed us to become the world's leading supplier of more than a dozen major categories of final finishes and related PCB products.

2013 promises more challenges, more changes to the industries we serve, and many more opportunities to help customers differentiate and succeed. We are ready.

Thank you for the opportunity to be a part of your success, and to our associates, thank you again for a job very well done.

Acid Copper Plating Course Offered at IPC

George Milad, Uyemura Technology Manager, will offer an IPC-sponsored course, "Acid Copper Plating for PWB Applications" at IPC Apex, on February 17 in San Diego.

The intense one-day course was created for plating engineers, engineering and production managers, QC engineers, electrolytic equipment designers and manufacturers, and PWB designers.

Electrolytic acid copper is the process that builds the traces that carry the current throughout the PWB. So, how best to optimize your electrolytic acid copper plating for today's challenging designs? (aspect ratios >20:1 for thru hole and >1:1 aspect ratios for blind via fill).

The challenge for acid copper is how it can continue to deliver the next generation of PWB designs, while maintaining tensile strength, elongation and thickness distribution.

Photo Courtesy of San Diego Convention Center

George Milad has 28 years in PCB manufacturing and is the Manager for Technology at UIC / Uyemura. George holds a Master's Degree in Physical Organic Chemistry from the American University in Washington DC, and is the author of the chapters on "Plating" and "Surface Finishing" in Clyde Coomb's "Printed Circuit Handbook." He has also authored numerous publications on electrolytic plating and is the recipient of the 2009 IPC President's Award.

International Conference Features Experts on Tin Whiskers Technology

The Department of Materials Research at Loughborough University and the University of Maryland's Center for Advanced Life Cycle Engineering (CALCE) held the 6th International Symposium on Tin Whiskers at Henry Ford College, Loughborough, England, on November 27-28, 2012.

Despite intense study, tin whiskers have remained a challenge. While advances in plating systems and monitoring have averted major short-term tin whisker issues, the lack of validated acceleration models and multiple avenues for whisker formation make the long-term use of tin plating a concern.

The two-day event featured presentations from BAE (USA), Celestica (Canada), European Space Agency (Netherlands), Micross Components (UK), the National Physics Laboratory (UK), Rolls-Royce (UK), and Uyemura (Japan), as well as Budapest University of Technology and Economics, Loughborough University, Osaka University, Purdue University, and the University of Maryland.

Presentations explored the role of lead in minimizing whiskers, examined corrosion-induced whiskers on SAC solders, presented a model for predicting metal whisker-induced metal vapor arc formation, and proposed a model for whisker growth.

George Milad presented data for Uyemura's GRX-70 electrolytic tin. GRX-70 alters the crystal structure of the tin deposit from large columnar typical of electrolytic tin into a smaller grain equiaxed structure similar to the structure of "non whisker producing" tin/lead. The new crystal structure dissipates compressive stresses induced by intermetallic formation, thus eliminating the primary source of whisker formation.

Symposium presenters, from left: Jacob Wang, George Milad, Barbara Horvath, Stephan Meschter, Barrie Dunn, Pylin Sarobol, Martin Wickham, Robert Gregory, Polina Snugovsky, Michael Swanwich, Michael Osterman, Mark Ashworth, Geoffrey Wilcox; (not pictured: Dr. Suganumo.)

He also reported on testing done by Dr. Werner Huegel, of Bosch Automotive Electronics Division, a world authority on tin whiskers. Uyemura's GRX-70, a high-speed electrolytic process proven to prevent whiskers formation in electroplated tin for at least 22,000 hours, was evaluated at Bosch, which confirmed the research findings of Uyemura.

The proceedings of the Symposium are available here: **http://www.calce.umd.edu/symposiums/ISTW2012.htm.**

GRX-70 Features:

- Produces an equiaxed crystal structure throughout the life of the bath
- Excellent solderability
- The tin deposit has a uniform white matt appearance after reflow.
- High deposition speeds for rackless and reel-to-reel processing
- High deposition efficiency over a wide range of current densities
- Bath is foam-resistant, and is also lead and fluoride free
- Operating temperature range is 113-131°F.

New Tech Center Appointments

Mark Eonta has joined Uyemura as Southeastern Territory Manager. He brings 26 years of sales, service and management experience with Electrochem/OMG in the North America and Asia markets. As Corporate Technology Manager, he oversaw a staff of R&D, technical, and product development professionals for many years before spending 12 years as Business Manager for the Far East market. Mark will also manage Uyemura's MEC product line.

Paul Gagne has joined Uyemura as a Chemical Blender. Paul has more than 15 years experience in chemical blending and production for the petrochemical, pharmaceutical, and specialty chemicals industries. Prior to being tapped by Uyemura, he worked as a chemical operator and supervisor for MacDermid. Paul is also experienced with reactor management, reclamation and in-process testing.

IPC Issues ENEPIG Specs

The IPC Plating Processes Subcommittee 4-14, co-chaired by George Milad and Gerard O'Brian, has finalized specifications for an ENEPIG Surface Finish, IPC-4556.

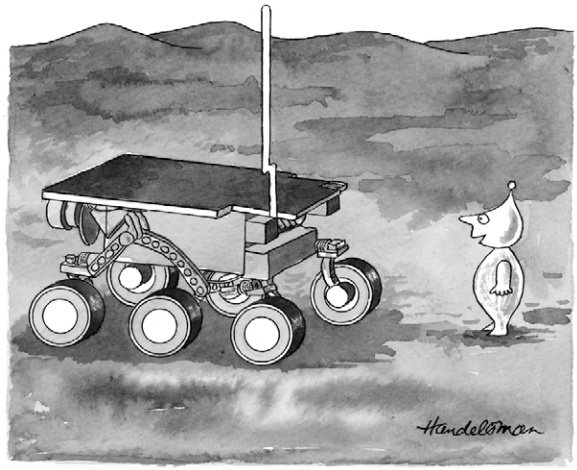
The electroless nickel thickness shall be 3 to 6 µm [118.1 to 236.2 µin] at ± 4 sigma (standard deviations) from the mean as measured on a nominal pad size of 1.5 mm x 1.5 mm [0.060 in x 0.060 in] or equivalent area, where standard feature size tolerances as expressed in the IPC-6010 standard series, apply. The upper end of this thickness specification has been chosen based on concerns with insertion force issues for compliant pin applications only. Use of thicknesses outside of this range shall be AABUS.

The electroless palladium thickness shall be 0.05 to 0.15 µm [2 to 12 µin] at ± 4 sigma (standard deviations) from the mean as measured on a nominal pad size of 1.5 mm x 1.5 mm [0.060 in x 0.060 in] or equivalent area, where standard feature size tolerances as expressed in the IPC-6010 standard series, apply. The upper thickness limit may be exceeded to meet special design criteria (for example, wire bonding). However, the committee has data showing that excessive electroless palladium thicknesses may impair solder joint reliability.

The minimum immersion gold thickness shall be 0.025µm [1.2 µin] at - 4 sigma (standard deviations) below the mean as measured on a nominal pad size of 1.5 mm x 1.5 mm [0.060 in x 0.060 in] or equivalent area, where standard feature size tolerances as expressed in the IPC-6010 standard series, apply. The specification is one sided, based on performance test results showing impaired solderability performance after accelerated aging at lower gold thicknesses. The nature of the reaction of immersion gold with electroless palladium is such that substantially greater thicknesses may not be achievable.

This important two-year effort saw major contributions from these OEMs: Raytheon, Lockheed Martin, Adtran, Boeing, BAE, Honeywell, Continental Automotive, Schneider Electric, Delphi, St. Jude Medical, RIM, Intel, HP and Oracle.

The Round Robin Test Summary is available through IPC. The sub-committee's next task is to update the (2002) specifications for ENIG.



"I'd like to say 'Hi' to my granddaddy in Roswell, New Mexico."

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Attribute	Specification	Result	Performance Rank
Ionic Cleanliness	IPC TM 650 1.54 NaCl micrograms/in2	0.8 NaCl micrograms/in2	40% less than the specification
Thickness uniformity	IPC 554 Category 3 minimum 40 microinches minus 4 sigma	46 and 52 microinches with a 1.5 St dev	Potential to satisfy category 3 requirements
Surface analysis	Crystalline morphology	Fine grain crystalline deposit	Preferred fine grain deposit resulting in excellent wettability
Solderability	EIA IPC J-STD-003C	Wetting time 0.68 sec as plated 1.1 sec after heat treat. Final force over 0.2 mN/mm	Wetting time improved with bath age
Soldermask undercut	No lift at tape test	Average mean 2.5 micron less than 0.1 mil	Allows potential for reworkability

UYEMURA INTERNATIONAL CORPORATION

Corp HQ: 3990 Concours, #425 • Ontario, CA 91764 • ph: 909.466.5635

Tech Center: 240 Town Line Road • Southington, CT 06489 • ph: 860.793.4011

www.uyemura.com