

# surface performance

## NEXT-GEN NANO-TECHNOLOGY PRODUCES HUGE ANTI-TARNISH ADVANTAGE FOR ELECTRONICS

### Organic layer leaves technical characteristics unaffected

Manufacturers of connectors and other electronic components face intense pressure to reduce layer thicknesses and minimize precious metal costs, while fulfilling performance requirements.

Requirements are typically five-fold, and include electrical contact resistance, corrosion resistance, wear resistance, solderability, and bondability.

New developments in nanotechnology have yielded an alternative coating that succeeds on all five fronts, and a recent (summer, 2015) reformulation has just made news with enhanced nanolayers that can be applied with standard immersion processing.

There's more. Introduction of new additives has boosted corrosion performance, particularly when enhanced with current. Monolayers applied with current support can be deposited at high density, and exhibit powerful crosslinking properties that significantly enhance performance. Additionally, the coating can be successfully deposited with an application cycle of under 5 seconds.

The reformulated product is Sealant 691, an elite anti-tarnish developed by Umicore; It is available exclusively throughout North America through

Uyemura. Recently, Sealant 691 was subjected to a battery of standard tests to qualify its performance.

### K2S ammonium sulfide test

Silver surfaces, which are highly sensitive to sulfur-containing corrosive media, were used to compare the corrosion and tarnish performance of Sealant 691.

Comparison of Antitarnish Systems

	Umicore 1st Gen Antitarnish	Umicore Sealant 691	Umicore Sealant 691 With Current
K <sub>2</sub> S-test 2% 5%	★ ■	★★ ★	★★★ ★★
(NH <sub>4</sub> ) <sub>2</sub> S test	★	★★	★★★
Na <sub>2</sub> S test	★	★★	★★★
Natural Aging	★	★★	★★★

★★★ Exceptional    ★★ Very good    ★ Good    0 Moderate    ■ Poor

Samples were immersed in the 2% K<sub>2</sub>S solution at 25°C for 5 minutes. The standard product showed corrosion after 240 seconds; patterns with the new anti-tarnish process remained fully functional after 5 minutes.



# Companies **Buy** Themselves **Bigger**

By Don Walsh  
Director of Operations

It has been a momentous year--- with our customer TTM taking over our customer Viasystems (which had previously absorbed Coretec and the DDi's).

Now a competitor is also on the acquisition rampage: Platform Specialty Products – the holding company that owns MacDermid –acquired the Specialty Chemicals division of OMG (combining the former Fidelity and Electrochem product lines); they will also purchase Alent (Enthone and Alpha).

*That's a lot of change!* What will Uyemura's position be in this reshuffled reality? We'll still have the strongest R&D resources in the world plating industry, and offer the best technologies and service to our customers. That will not change, and competing with other giants has never in 20+ years stalled our growth trajectory.

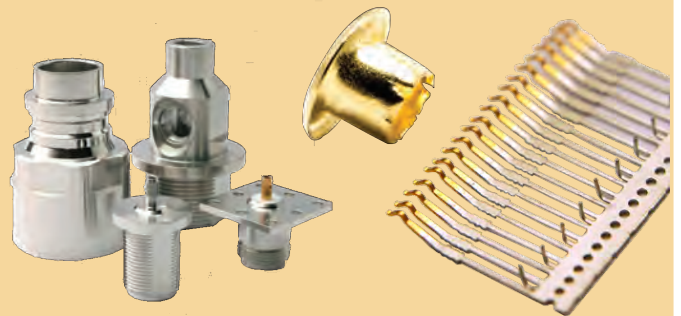
OMG/Fidelity, Enthone, MacDermid and Electro Chemicals were all big before UIC technology arrived in the US. It was UIC, however, that brought workable electroless golds to the market. And it was Uyemura science that led the way to optimum specs for ENIG and immersion silver in the technology sector.

Before we brought clarity, a lot of costly scrap was produced as a result of bogus thickness specifications.

**We remain strong in North America for a good reason----our chemistries work better.**

Specifically, our products:

- Give the market a cost-effective alternative to silver, palladium and nickel for a broad range of applications.
- Use advanced nanopolymer technology to protect, and permanently preserve the brightness of silver.
- Seal gold's natural porosity more effectively than alternatives by penetrating the metal's grain structure.
- Provide long-term protection from water and corrosive damage for electronic parts.
- Improve hard chrome performance.
- Prevent staining on low carat red gold.
- Allow nickel phos to be added to an existing electrolytic gold line, so that it becomes a simple drop-in process.
- Allow substantial reductions in gold thickness in the connector industry.
- Offer a cost-saving alternative to EN, with virtually unlimited bath life, and less waste.



We are also proud to have as partners other world leaders in gmf technology: Germany's Umicore Galvanotechnik and KWH-Technologies, Belgium's Europlasma, and Japan's MEC.

***The past has been good to us, and our valued customers. All of us at Uyemura hope you will experience with us what promises to be a bright and productive future.***

**The performance of Sealant 691 is enhanced with the application of current.** The pattern was immersed in a 2% K2S solution for 10 seconds and electrolytically treated with 5 V current. After 7 minutes, no change was evident, while samples immersed without current exhibited clear evidence of attack.

Current increases protection levels - and in a very short time. As a result, high throughput speeds are possible, and the product is well suited to continuous plating lines.

### Friction force reduced 95%, gliding properties improved

The mechanical behavior of electronic components was also studied. For this phase, plug contacts were used to determine the impact on the coefficient of friction after the anti-tarnish coating was applied.

To determine the friction coefficient of an untreated surface, a pure silver pattern was used. A hard gold surface was also tested. A coefficient of friction of just over 1 was achieved. Following application of the anti-tarnish layer on the silver surface, the coefficient of friction was reduced more than 95%.

#### Sealant 691 Reduces Friction Force

COF (coefficient of friction)



Pure silver without sealing  
COF: 0.76



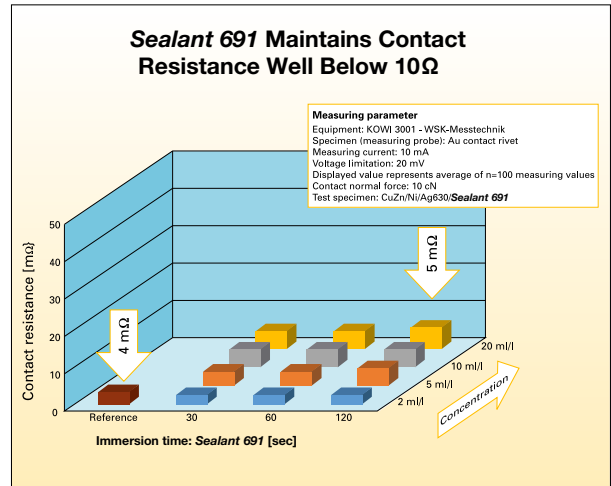
Pure silver with Umicore Sealant 691  
COF: 0.04

### Zero Degradation of electric properties: contact resistance uncompromised

For electronic components, contact resistance is a fundamental requirement. Connectors, for example, must be fully functional following application of a protective layer. A third set of tests looked for changes in contact resistance.

The reference pattern with a pure silver layer had a contact resistance of 4 Milliohm. After application of the antitarnish layer, contact resistances of less than 10 Milliohm were seen, even at highest thicknesses and bath concentrations.

Investigations showed that the level of contact resistance was virtually unaffected.

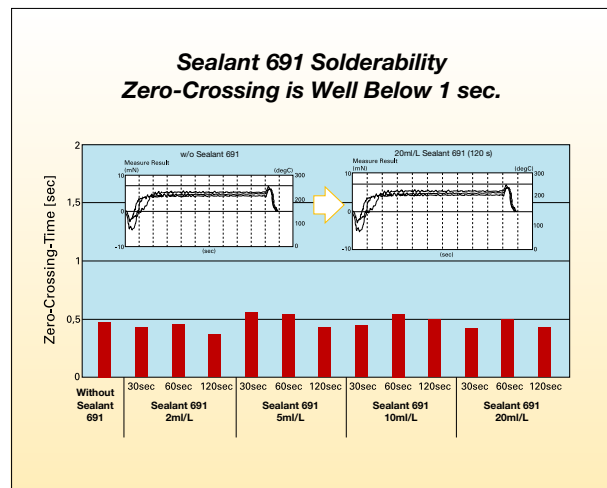


### Bondability

During gold wire bonding deduction tests, all test samples met the objectives of DVS-specification 2611: i.e. to achieve a minimum withdrawal force of 4 grams at a load of 11 cN. All patterns treated with all concentrations exhibited more than twice the removal force required of the specifications. On average, the values were at 10 grams.

### Solderability

The impact on solderability was determined using the zero-crossing test. The anti-tarnish coatings achieved complete wetting in significantly under one second, demonstrating that they are fully compatible with soldering.



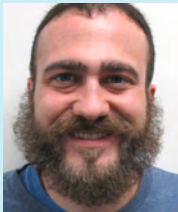
## Uyemura Expands Development and Logistics Teams



Bill Parente is an analytical chemist with extensive experience in new product development. Most recently, he was a scientist for Chemtura, (Uniroyal) serving on its elite Analytical Core Team.



Jeff Arnson has been tapped as UIC's Manager for Shipping and Receiving. His responsibilities include carrier negotiations, team management and the implementation of lean logistics (Kaizen principles.)



Nick Foligno is the newest addition to UIC's team. His responsibilities include shipping and receiving, and inventory management. His previous post was at Honeywell.

*The growth of Uyemura's US operations has been continuous, and significant since 2010.*

(cont'd from p.3)

### Neutral Salt Spray (NSS) test: Only minimal changes after 72 hours

Protection performance was studied in combination with ultra-thin hard gold layers. Brass samples with a layer of nickel (2-3 microns) and a final layer of gold-cobalt (0.08 microns) were tested for anti-tarnish protection.

After a 10-second dwell time at standard concentration using current, samples with a deposit layer showed no visible corrosion after 72 hours. Patterns on which a monolayer was applied showed minimal corrosion.

The comparative sample without protection had distinctive corrosion sites after 72 hours.

### ANTI-TARNISH TECHNOLOGY TODAY

Umicore's new generation of nanotechnology-based anti-tarnish processes from Uyemura provides a high level of protection, and more robust technical properties, compared with alternatives available in the US, Europe or Asia. Contact times are short, and the process is compatible with standard immersion practices and continuous plating lines. When electrical potential is applied, full performance characteristics are achieved with 5-10 seconds of dwell time.

Sealant 691 with current delivers the highest levels of protection, the greatest application flexibility, and exceptionally high productivity for technical surfaces, including silver, gold and palladium-nickel. The product does not contain HCFCs, CFCs, or chromium, and is solvent-free, making it friendly for both the environment and workers.



*"Not you, too, Larry. Pumpkin-flavored?"*

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