

Aluminations

The Quarterly Newsletter of AlumiPlate, Inc.

Plating With Aluminum

Best Life Cycle Cost: AlumiPlate™ Aluminum's Corrosion Resistance Helps You Get There

By F.A. Sandy Donaldson

The concept of Best Cost is spoken of throughout industry and government. Yet the concept is not well understood or practiced by most. At the component level, specific examples abound of infamous toilet seats (\$1,500) and hammers (\$500); but what are the positive examples that have reached almost daily vernacular?

One reason that admirable, inspiring examples are hard to name is that most companies find it very difficult to measure or analyze life cycle costs, and, by its very nature, best cost is a comparative or a relative measure. If a component has a low acquisition cost but it fails prematurely, what total cost is incurred and attributable to that part? Is it a disaster or a minor inconvenience? Do you lose a life or a customer or just a notch in the minds of customers? What is that worth? How much more would you need to spend (if any) to prevent that premature failure?

If we pretend that we have the cost information, its fairly easy to see how, for example, bolts coated with a corrosion resistant coating that fails to protect them from corroding prematurely (say, during the warranty period) can "cost" a company far more than the bolts are worth. The list of costs could look like this:

1. Labor to replace the bolts - \$20.⁰⁰
2. Proper disposal of the corroded bolts - \$1.⁰⁰
3. New bolts (same coating?) - \$15.⁰⁰
4. More difficult-to-quantify costs such as loss of future or repeat business, or labor to repair other components that are damaged as a result - pick a number, say \$5.⁰⁰

Obviously in this case, it could save the company money in the long term to use bolts with adequate corrosion resistance - either stainless steel bolts or bolts that have been coated with a superior corrosion resistant plating such as AlumiPlate aluminum. Assuming that the plating costs less than switching the bolts to stainless (a fairly safe assumption) and that the aluminum plating does prevent premature corrosion (another fairly safe assumption), the best cost solution in this example is to use the aluminum plating.

In 1995, the Battelle Institute reported that corrosion costs the U.S. economy over \$300 billion annually! Most of that is preventable, according to the study. We founded AlumiPlate on the premise that we could help our customers reduce some of that cost by preventing some of that corrosion through plating with aluminum. Call us today for a quote. ■

Salt Spray Test Panels



The above photo shows ASTM B117 Salt Spray Test panels after 1,020 hrs (left) and 1,933 hrs (right). These are as-plated (no chromate) 1.0 mil min. AlumiPlate aluminum over steel. The left panel shows minor discoloration and the right panel shows some white corrosion product, BUT No Red Rust on either of the panels indicates excellent corrosion resistance performance. To see a color photo of this and other test results, please visit our web site at www.AlumiPlate.com.

Optics News - AlumiPlate Aluminum Helps Athermalize Cryo- genic IR Mirrors

Space-based or high precision IR instruments many times must operate at "cryogenic" (~65° K) temperatures and/or during severe temperature fluctuations. Similar coefficients of thermal expansion (CTE) of AL6061 mirrors and a diamond turnable layer of AlumiPlate high purity aluminum may make aluminum the plating of choice for some applications that require minimized bimetallic warping.

Recent testing done at the National Optical Astronomy Observatories (NOAO) has shown very exciting results. A team led by Dr. Daniel Vukobratovich found that a diamond turned

AlumiPlate aluminum plated (6061 substrate) mirror performed extremely well during temperature cycling from ~65° K to room temperature to 300° K. The average RMS optical surface error at 300° K was 0.248λ rms (λ= 633nm) with a standard deviation of 0.020, and at ~65°K it was 0.213λ rms with a standard deviation of 0.012. Dan commented that these results "are within experimental error" of the measuring equipment.

"This is the most stable cryo mirror we've ever had the pleasure to handle." - Dr. Dan Vukobratovich, NOAO.

Dr. Vukobratovich co-authored and presented a technical paper at last year's SPIE 97 annual meeting which detailed a study of several different designs for and (largely unsuccessful) attempts to construct and to figure high precision, thermally stable, nickel plated 6061-T6 aluminum substrate mirrors for a temperature range of ~ 60° - 300° K. One comment made in the paper was "a significant disadvantage of nickel plating is the difference in CTE between the most common plating material, electroless nickel, and metal mirror substrate materials". The difference in the CTE's caused bi-metallic bending of the mirrors at desired operating temperature ranges which led to unacceptable surface figure errors. Dr Vukobratovich is planning another paper at the 1998 meeting, detailing the results of this latest study.

Our conclusion: Aluminum plated 6061-T6 aluminum mirrors minimize CTE differences, which can provide a "same material athermalizing" effect, minimizing surface figure error.

Our thanks to NOAO and Dan Vukobratovich for including AlumiPlate in this study and for his willingness to share results with our readers. ■

Other new optics test results on AlumiPlate aluminum.

Many thanks to Dr. Alan Hedges of II-VI Corp who provided AlumiPlate with an outstanding **18 angstroms rms** diamond turned surface finish on a 2 inch diameter 6061-T6 flat mirror plated with 0.005" (5 mils) of AlumiPlate™ High Purity Aluminum. Dr. Hedges also diamond turned a **36 Å rms** surface finish onto an aluminum plated 3 inch diameter, **5 inch off-axis parabolic mirror**. ■

**Visit us at NACExpo 98
San Diego Mar. 22-27, 1998**

The AlumiBuzz... Applications Update

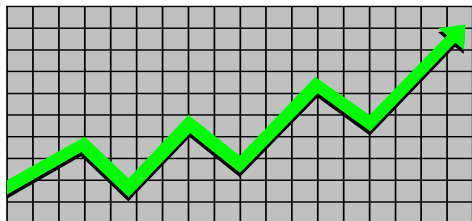
Springs

New corrosion test results just in....

One of the best ways to protect steel springs from corrosion is to plate them with a thin, highly corrosion resistant, dense metallic aluminum layer that is ductile (will not flake or peel when flexed) and will withstand high temperatures. AlumiPlate aluminum has excellent corrosion resistance properties in chloride and sulfur dioxide-rich atmospheres.

AlumiPlate™ aluminum plating has been tested by independent labs and customer labs with excellent results. One of the most rigorous tests has been conducted by a large American boat motor manufacturer, Mercury Marine, Fond du Lac, WI. On-motor field testing was conducted in the Gulf of Mexico with excellent results. And...

In Mercury Marine's very aggressive modified cyclic salt spray test, AlumiPlate™ aluminum plated retaining ring springs have survived an outstanding 7,200 hours. Longer than any plated surface has lasted before... even cadmium!! ■



Thermal Management AlumiPlate Aluminum Plated Over Copper - Attractive Possibilities.

In your design mind, think of the possibilities. Copper components with a thin, high purity aluminum "skin"... electrical and thermal conductivity of copper. Corrosion resistance, bondability, material and galvanic compatibility of aluminum. Bus bar, heat sinks, tube & fin assemblies, electrical connectors and switches, thermal planes, and electronics enclosures come to mind. In order to provide a reliable path for heat and/or electrical conductance, they must be protected from rough field handling as well as the environment. Let us know your ideas! ■

ALMMCC Kickoff Now Set

We announced in our Fall issue of *Aluminations* that the kick-off meeting for the Aluminum Metal Matrix Composite Consortium (ALMMCC) would be held in October but that meeting was postponed.

This new organization has been formed with the mission of facilitating expanded application of these materials in commercial and military products by developing manufacturing process technology, design confidence and increased awareness. **The official kick-off of the Consortium will be held Feb. 12 - 14, 1998 in San Antonio, TX** (just prior to the TMS Annual meeting in the same city the following week). For further info on the kickoff or membership in the consortium, please contact:

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Upcoming Events '98

SUR/FIN '98 - June 23 - 25, '98 - AlumiPlate's home town of Minneapolis is the site for the annual Surface Finishing conference and exposition co-sponsored by the AESF (Am. Electroplaters and Surface Finishers) and NAMF (Nat. Assn. of Metal Finishers). AlumiPlate will exhibit at the show.

SPIE '98 - July 19 - 25, '98 - AlumiPlate will exhibit at the Soc. of Photoelectrical and Instrumentation Engr. Annual meeting and conference in San Diego.

CASMI 1998 All Springs Conference - Oct. 13 - 15, '98. AlumiPlate will exhibit at Chicago Area Spring Manufacturers biennial show at the Pheasant Run Resort in St. Charles, IL. The CASMI show with spring manufacturers and distributors, spring manufacturing equipment, and suppliers of spring coatings the only one of its kind in the U.S. dedicated strictly to the spring industry. For more information on CASMI or the show please contact Mr. Jerry Reese at 847.433.1335.

Photonics Spectra Feature Article Covers Diamond Turned AlumiPlate Aluminum Benefits

Dr. Tuckerman Moss has published an excellent feature article in *Photonics Spectra* magazine in the December '97 issue. The article, entitled, "*Diamonds Turn Out Precision Optics*", includes a summary of the history of diamond turning metal optics, some of the applications and capabilities of diamond turning and a glimpse of the future of diamond turning. This is definitely recommended reading for our optics friends. ■

The AlumiPlate Lair You ask these things of us...

- Technical Assistance - we have mechanical, metallurgical, chemical and process control engineering resources on staff to assist you in your application/design.
- Turnaround - our lead times continue to be reduced.
- Information - we have implemented our state-of-the-art order entry, tracking and management system, DCD Vista.
- Quality - our Quality System has progressed as evidenced by improvements made in successive quality audits by the same customer. This will be, of course, a continuing process.
- Competitive Pricing - we continue to improve our costs and as we grow and scale up our process, our costs have been and will continue to be more competitive. Call us today!

New Representative in Texas

AlumiPlate, Inc. is pleased to announce that it has appointed **Rep-Logic, Inc.** as its sales representative in Texas. Rep-Logic principal, **Jeff Berlin** has over 15 years of experience in engineering and sales in the aerospace and microelectronics industries. Rep-Logic also represents aerospace fastener distributor and kit supplier United Fastener, among others. We are very pleased to have new, high quality representation in this important region.

In Texas, contact Jeff at:

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AlumiPlate Web Site Updated

We are updating our website with the latest information and results from customer testing. Check us out at www.AlumiPlate.com

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