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Featured Projects

Navy's New Aluminum Anodizing Process is Safe and Effective

By Gretchen Jacobson

NADEP, the Naval Aviation Depot in Jacksonville, Florida, is the Navy's premier engine facility. Its 2,500-person workforce re-works jet engines, repairs and modifies aircraft, and maintains tens of thousands of aeronautical components. To prevent the corrosion of aluminum parts, technicians at the depot often use a protective method known as anodizing.

Anodizing is an electrochemical process, unique to aluminum, in which an oxide coating is formed on the surface of the metal. During the process, an aluminum part is immersed in an electrolyte and is positively charged using direct current from a rectifier, a power source. Oxygen ions from the electrolyte move toward the anode—the aluminum component—and combine with aluminum ions to form a porous, protective layer of aluminum oxide.

Although anodized coatings are very effective in protecting aluminum, there have been problems associated with traditional application methods that involve manually operating and adjusting the rectifier to supply the required current.

"Anodizing by manually controlling the voltage not only introduces inconsistent and non-reproducible results, but it increases the risks of defects and rejects," said Ruben Prado, a process control chemist and surface-finishing expert at NADEP. "This method is also sensitive to operating parameters, including bath chemistry, temperature, the specific alloy being anodized, and size of load, which can jeopardize coating quality."

To meet these challenges, depot engineers analyzed and installed a new computerized anodizing technology in 2003. Developed by METALAST International, Inc. of Minden, Nevada, the process control system has significantly enhanced the quality of corrosion- and wear-resistant coatings that are applied to aluminum aircraft component parts. The system is also cost-effective and environmentally friendly, Prado said.

"The METALAST process controller has made anodizing much easier for shop artisans while lowering the risk of damaging parts," Prado said. "It has also freed time spent at the rectifier, making the overall process more efficient." Because of the technology's precision control, chemicals and energy are used more efficiently and less dumping of the bath is required. "Overall, it is better for the environment," he said.

The system consists of an integrated process controller called JobPro, an interface controller, and a proprietary chemical additive, METALAST AA-200, for the bath chemistry. The controller can automatically regulate rectifier voltage and current output, process ramping, stepping, and timing. Once the process has been set up and started, the operator does



At the surface-finishing shop, Ruben Prado, a NADEP process control chemist, enters a "strategy" into the Metalast Integrated Process Controller (JobPro) before anodizing the main landing gear of a Navy EA-6B Prowler.

not need to constantly monitor it. In the past it took operators 10 to 15 minutes per run to manually ramp, monitor, and make adjustments to the rectifier.



The main landing gear of an EA-6B Prowler is processed in a modified anodizing tank.

The additive used in conjunction with the control system is a combination of organic monomers specially formulated to prevent the anodized metal from "burning" during the primary stage of the aluminum anodizing process. The formulation helps build a hard, dense oxide and allows the operator to run at high current and voltage settings.

"By incorporating control of the bath chemistry and all operation system parameters together with the process control system, finishes can be custom-tailored to enhance certain performance characteristics, such as paint adhesion, corrosion resistance, wear, or hardness in nearly half the time it takes traditional methods," said Prado. "The bath additive plays a major role in the quality and uniformity of the coating produced."

Anodizing using the METALAST Process Controller has shown significant benefits to NADEP Jacksonville. Plans to evaluate the technology further are underway. NADEP Jacksonville's ultimate goal is to make METALAST the new standard for anodizing aluminum alloys within depot-level maintenance, Prado said.