



## Economical Nonchromate Conversion Coatings

### Technology

Two nonchromate conversion coating processes were developed to coat both aluminum alloys and ferrous metals. The coatings enhance both adhesion and corrosion resistance. Both processes use materials that are low cost and require no specialized or expensive equipment.

### Benefits

- No chromate materials are used
- Use of inexpensive materials
- No toxic by-products are generated
- Low processing costs
- Low processing time

### Commercial Applications

- Construction industry: surface treatment of metals used in steel structures, aluminum doors, and window frames
- Sporting goods: adhesion and surface treatment of baseball bats and bicycle structures
- Automotive industry: surface treatment of alloy wheels and other aluminum alloy components
- Aerospace industry: adhesion and surface treatment of aluminum skin
- Extrusion and die casting: surface treatment for aluminum alloys
- Metal screws and nuts: improvement of corrosion resistance

### Technology Description

With the rise of environmental awareness and the renewed importance of environmentally friendly processes, surface pretreatment processes based on chromates have been targeted by the United States Environmental Protection Agency. Chromate processes have been subject to regulations under the Clean Water Act as well as other environmental initiatives, and there is today a marked movement to eliminate these processes in the near future. Consequently, there is a clear need for new advances in coating technology that could provide practical options for replacing present industrial practices.

The nonchromate conversion coating process for aluminum alloys is essentially a drip process. A pre-cleaned aluminum alloy substrate is immersed in an aqueous solution at room temperature for 2 minutes. The aqueous solution consists of three low-cost chemicals present in small concentrations. The aluminum alloy substrate is then withdrawn from the aqueous solution, rinsed with water, and allowed to dry. At NASA Glenn, the coatings were characterized by x-ray photoelectron spectroscopy (XPS) and Fourier transform infrared microscopy (FTIR) techniques.

The nonchromate conversion coating process for ferrous metals, such as low carbon steels, is a vapor deposition process. A small amount of an organic liquid solution is injected into a heated (275 °C) oven that contains the ferrous metal substrate. The organic liquid vaporizes and the vapor reacts with the metal surface producing a coating. Different coatings can be deposited on the ferrous metal surface depending on the precursor materials.

### Options for Commercialization

This technology opportunity is part of the NASA Technology Transfer Program. The program seeks to stimulate development of commercial applications

from NASA-developed technology. The coating process has been defined and properties of the conversion coatings have been tested at NASA Glenn. Additional development might be needed to optimize and further refine the coatings for specific applications. NASA is seeking partners to take this technology to the next step.

If your company is interested in low-cost environmentally friendly conversion coatings or if you desire additional information, please contact us.

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## References

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## Key Words

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