

Category: Materials, Coatings & Processes

Reference: TD-DE-1029

Protective layers by nickel plating

To protect the surface of a design model against particles of high kinetic energy, it is chemically nickel plated using the DURNI-COAT® process (DNC). The protective layer on the outer skin of a demonstrator in a supersonic wind tunnel has a thickness of 30 µm.

The DURNI-COAT® process consists in electroless deposition without any external source of electricity. In this process the workpiece is immersed into an aqueous process solution with a specific content of nickel ions. During the process these ions are reduced into metallic nickel. The chemical reacting agents and formulators of the electrons required in this process are the hypophosphite ions in the solution. These agents are transformed, by oxidation in the course of the reaction, into orthophosphate. A nickel-phosphorus alloy layer forms on the work piece's surface. This layer effectively protects the workpiece against wear and corrosion. By variation of the electrolyte and process parameters the layer's properties may be customized to specific applications. Prior to the surface treatment an accurate coverage of the cast body's interior, the tolerance dimensions of the control tabs by a special masking lacquer or tape is required. Covered areas will not be coated during the dipping of the parts into the nickel-electrolyte. After the treatment the coverage may be removed without problems. In spite of an increased number of examinations the chemically nickel plated surface resisted very good to the impositions in the wind tunnel.



Most of the industrially utilized metals may be improved by this procedure. A specific pre-treatment provide surface properties for an even and extremely adherent layer on the workpiece. The even layer allows a narrow layer thickness tolerance which normally amounts to $\pm 3 \mu\text{m}$.

The example of an application of the coating process displays a demonstrator for a Crew Rescue Vehicle which will enable a fast evacuation of the crew of the International Space Station ISS in case of emergency. The X-38 should prove in an unmanned flight that a rescue mission is possible including the actions automatic flight, leaving the orbit, re-entry into earth atmosphere, descent and landing. Based on the X-38 test plant the Rescue Vehicle is currently under construction. Aero dynamical experiments were conducted with a X-38 design model with 30 cm of length made of the alloy AlZnMgCu0,5 F35 (CERTAL).

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Innovative Aspects:

The layers are particularly suitable for applications with high requirements to:

- high truth to the original contours and dimensional accuracy,
- slippage,
- protection against corrosion, erosion und cavitation,
- connectivity and solderability,
- hardness and wear resistance,
- magnetic properties,
- conductivity of the surface.

Application Areas:

The described surface processing is a functional coating with a high-grade protection value for technical applications in the following industrial areas:

- Aerospace,
- General Mechanical and Plant Engineering,
- Energy and reactor technology,
- Hydraulics,
- Automotive,
- Mining,
- Pharmaceutical and medical tool building,
- Food and home appliance industry,
- Instrumentation and control technology.

Cooperation:

The donor is interested in co-operations as well as in selling his coating services designed for individual and specific demands.