Zn-Ni Synopsis

4 - takeaways

Keywords & Acronyms Zn-Ni.com

Dennis Dent
Airfasco.com
Founder & CEO

1. Health & Safety (Cd/Cr6+):

The use of Cadmium (Cd) is a contentious issue due to its toxicity and related health and environmental risks. Adding yellow QQ-P-416 Hexavalent Chromate (Cr6+) after the cyanide electroplating bath process compounds these health and safety risks. Previous research has shown that these materials can be carcinogenic. European regulatory analysis and oversight is required under REACH regulations. Despite this, temporary Cadmium exemptions for fasteners, which are limited to 0.1% by weight for homogeneous materials are currently in place. However, the use of alkaline Zinc-Nickel plating bath as a substitute is a cleaner, environmentally friendly alternative. Zn-Ni complies with regulations and is REACH & RoHS compliant. Considering the potential hazards of Cadmium and Chromium, transitioning to safer alternatives such as Zinc-Nickel plating should be encouraged.

2. Solves Hydrogen Embrittlement (HE):

The primary electroplating bath solution is water H2O. Hydrogen atoms 2H+ are much smaller than the atoms of the metal substrates that migrate during electrolysis which involves the passage of electric DC+ current through an electrolyte containing ions of the metal to be plated. Zinc Nickel plating has been around for decades. Recent work has proven that an alkaline plating bath with tighter controls on the composition of the zinc nickel coating can produce a gamma phase zinc nickel that provides higher corrosion protection and allows for hydrogen gas 2H+ bake out after plating while creating unique straw like holes for natural escapement over the lifetime of use. It has been approved by the USAF since 2010 for use on high strength aerospace steels. This new well-established process is an effective solution to lessen hydrogen embrittlement in aerospace metal fasteners and components.

3. Superior Corrosion (Zn-Ni):

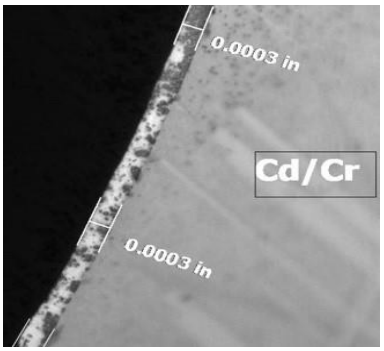
Nickel provides greater resistance against harsh chemicals and environmental factors. The unique alkaline bath blend of the Zinc-Nickle solution creates gamma-phase (y Zn-Ni) combatting corrosion. Gamma-phase is a metallurgical process resulting in leading corrosion resistance capabilities that surpass the stipulated QQ-P-416 Cadmium requirements. The photo below shows proof of corrosion resistance after 2.5 years of beach exposure.

4. Direct Replacement:

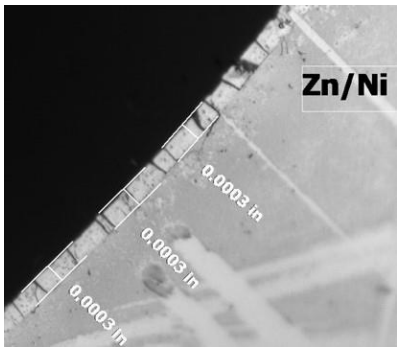
With the introduction of AMS2461, Zinc-Nickel electroplating is a direct replacement for QQ-P-416 Cadmium, highlighting its similarity in terms of thickness and coefficient of drag for fastener applications. Before bare metal plating fastener sizes remain the same with no tooling change cost incurred and similar plating costs.

The USAF has noted no detrimental effects as result of implementation. Several industry wide specifications have been published recently that result in LHE Zn-Ni coatings such as AMS2461, MIL-PRF-32660 and MIL-DTL-32648.

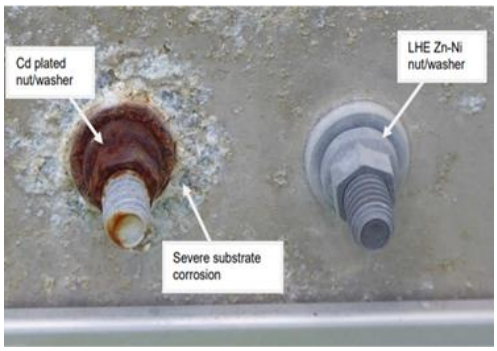
A picture is worth a thousand words. Photographs are courtesy USAF, Nathan Hughes, Technical Advisor.



Cd/Cr class 2 thickness .0003”



Zn/Ni class 2 thickness .0003”



Beach exposure 2.5 years