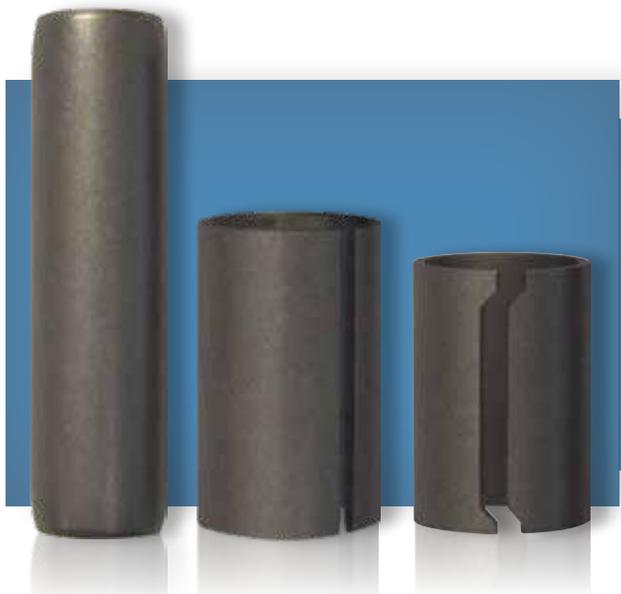


SPIROL®

WHITE PAPER

Features and Benefits of ArmorGalv® Thermal Zinc Diffusion

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SPIROL International Corporation



ArmorGalv® Thermal Diffusion

1,000+ HOURS

corrosion resistance

Thermal Diffused Zinc, a finishing process historically known as Sherardizing, has been used for corrosion protection of metal parts for over a century. Over the years, improvements have been made to the Sherardizing zinc/iron diffusion process. The modern, greatly improved process, known as **ArmorGalv®** is now being introduced as a standard finish for **SPIROL** products, and is poised to revolutionize the market. ArmorGalv® is anodic to steel and as such, provides long term sacrificial galvanic protection. Unlike traditional electroplating there is no risk of hydrogen embrittlement, adhesion is superior, coating thickness uniform, and all surfaces are covered. **There are no insignificant surfaces.** The affordability, durability, and low environmental impact of ArmorGalv® makes it ideal for today's market.

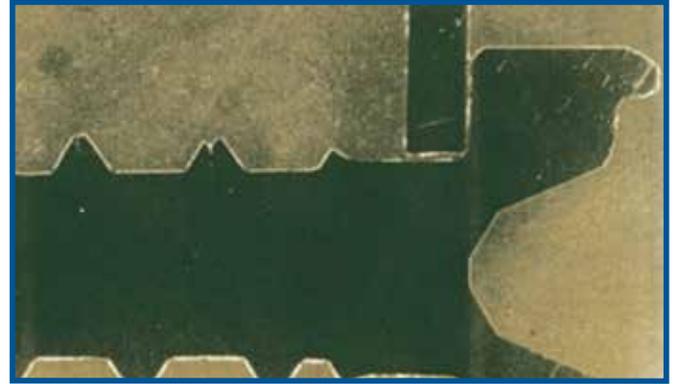
ArmorGalv® is a zinc alloy thermal diffusion coating, and is covered by ASTM A1059M-08(2013). This process requires a closed container, heated to a minimum 343°C (650°F), with a powdered zinc mixture. At this temperature sublimation of the zinc mixture occurs and it is dispersed into the container as a vapor. Being soluble in iron, the zinc vapor subsequently diffuses into the surface of ferrous parts. Volume of the zinc mixture is calculated based upon total surface area of the parts resulting in excellent control of resultant thickness with near total consumption of the zinc powder. After the diffusion, specially designed topcoats and sealers are applied to complete the finish. The United States Environmental Protection Agency has stated this finish approaches zero emissions and it has received recognition and awards for its contribution to pollution prevention. There is no hazardous chemistry and water consumption is extremely low. In addition to these benefits, ArmorGalv® exceeds the performance benchmarks of many competing solutions.

SPIROL recommends ArmorGalv® coating as an alternative to traditional platings and coatings for many reasons; chief among them product quality, maximum corrosion protection/performance, cost effectiveness, and environmental stewardship. Primary benefits of ArmorGalv® are:

- 1,000 hours or greater corrosion resistance** of time to red rust (base metal attack)
- ZERO** risk of hydrogen embrittlement
- Will not reduce fatigue strength of material** (applicable to all alloys including stainless)
- Uniform deposition of coating** on all surfaces (**No insignificant surfaces**). All internal features or ØID's receive full coating and protection
- Cost effective**
- Anti-galling** characteristics similar to cadmium (may be applied to stainless steel)
- No flaking, peeling, or blistering** – approximately 1/3 of finish thickness is diffused into the coated surface effectively becoming part of the component
- Hard and highly abrasion resistant @ 37-42 HRC**
- Slightly porous surface** will retain paint and other coatings in the event complete pinned assembly requires subsequent painting, powder coating, etc.

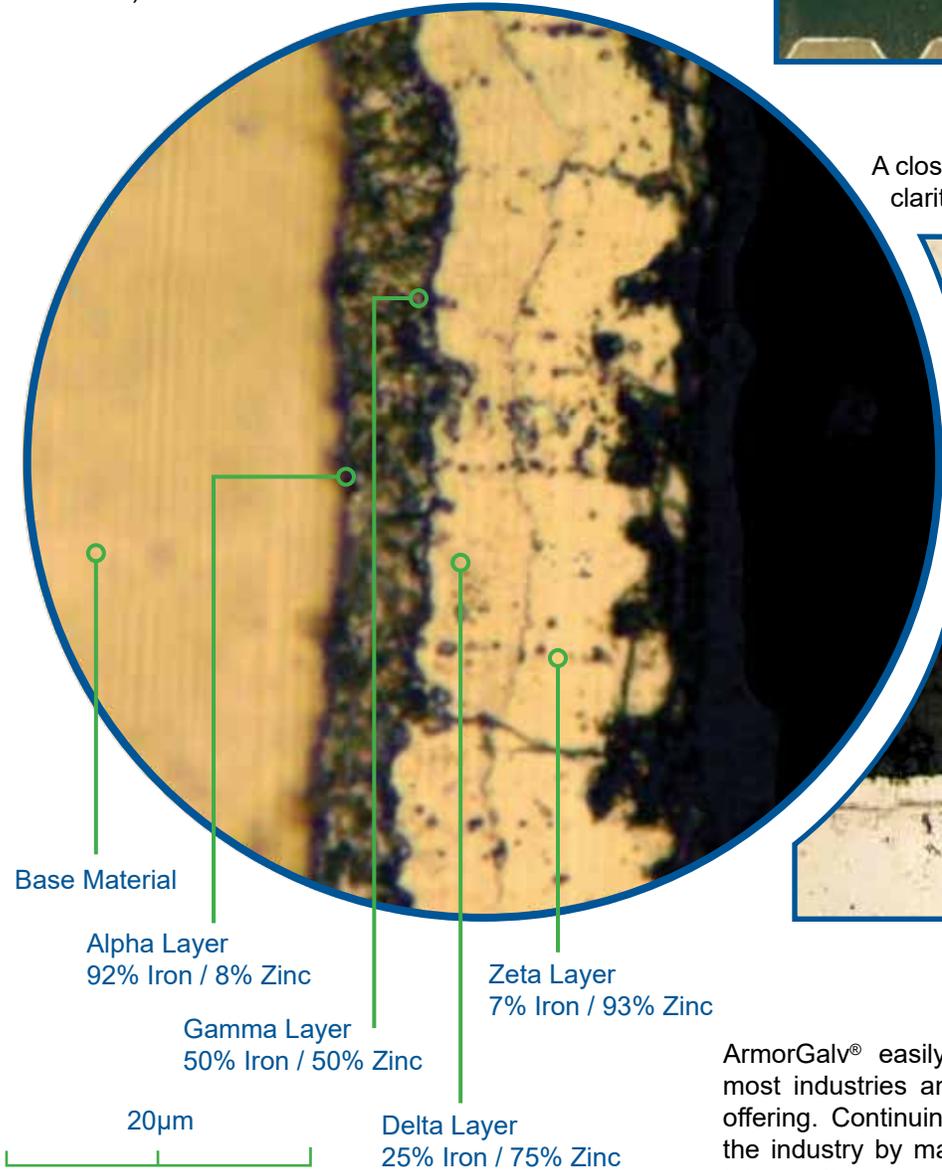
ArmorGalv® offers a low risk, cost effective, high performance alternative to many of today's platings and coatings. With ever-increasing performance and life cycle requirements, this coating is an ideal solution for fasteners used in some of the most aggressive environments such as marine, automotive, mining, and industrial manufacturing. The following photographs provide visual representation of this coatings effectiveness.

Uniformity of deposition is visible in the following photographs. Note coverage of all surfaces including peaks, valleys, corners, and gaps:



Fastener and washer with ArmorGalv® coating.

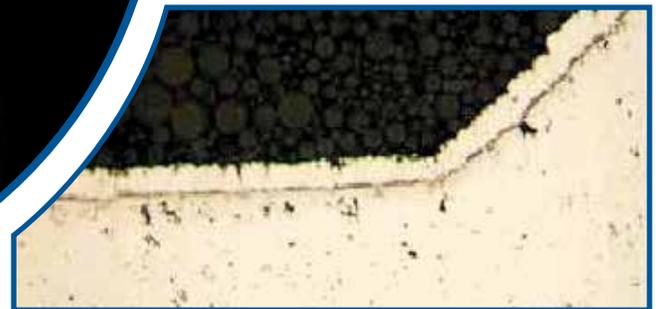
The image below demonstrates the layered structure of ArmorGalv®. Maximum percentages of zinc occur at the surface with the percent iron increasing with depth (20 microns average coating thickness is applied to SPIROL fasteners):



A closer cross-section with thicker deposition for clarity in the two images below:



Powder Metal Parts Before ArmorGalv®



Powder Metal Parts After ArmorGalv®
(100 microns / 4mils)

ArmorGalv® easily exceeds the corrosion requirements of most industries and is ideally suited for SPIROL's product offering. Continuing their 75+ year tradition of innovation in the industry by making the investment in the equipment and tailoring the process to meet the specific needs of their product lines, SPIROL is able to offer this superior coating as an in-house process at a cost-effective price. As stated by SPIROL's Marketing Manager, Christie Jones, "SPIROL is proud to be a part of the ArmorGalv® family. This is most definitely a game-changer for the fastener industry!"

**ArmorGalv is
RoHS and REACH
compliant.**

Contact SPIROL today for more information about ArmorGalv®!



**Innovative fastening solutions.
Lower assembly costs.**

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SPIROL offers complimentary Application Engineering support! We will assist on new designs as well as help resolve issues, and recommend cost savings on existing designs. Let us help by visiting **Application Engineering Services** on **SPIROL.com**.

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