The Case for Galfan®

The Techs, highly recognized by the Jacobson Survey for quality and service, is a premier hot-dipped galvanized steel sheet producer with three facilities in Pittsburgh, PA – MetalTech, NexTech, and GalvTech. Its parent company, Steel Dynamics, Inc., is the 5th largest steel producer in the United States and has, among other product offerings, the capability to produce many value-added coated sheet products such as Galvanized, Galvanneal, and Galvalume®.

Historically, The Techs produced only Galvanized, but chose recently to add another hot-dipped coated product to complement the Steel Dynamics portfolio. Beginning in January of 2012, The Techs partnered with the Galfan Technology Centre, the owner of the Galfan trademark, to begin Galfan trials. After several successful production runs, excellent corrosion results, and positive customer feedback, The Techs became a Licensed Galfan Producer in late 2012.

Galfan, 95% zinc / 5% aluminum may ring a bell to many in the North American steel industry. While some may recall or have read about Weirton Steel Galfan production many years ago, most are unfamiliar with the product and its potential benefits. Galfan has had great acceptance in Europe, Asia, and Canada since its creation in 1981, but other than wire fencing, it has not been regularly produced in the United States. That is until now.

The time is right for Galfan to take hold in the United States. Continued focus on material costs and the drive for sustainability and green products have pushed many companies to look for alternative coating chemistries. The Techs have seen the same push in years past with the chemical treatments on coated steel moving from chrome to non-chrome surface treatments. Now these chemicals are commonplace and growing in use every day. The same may hold true for alternative zinc coating chemistries.

In researching new products, magnesium containing chemistries were reviewed. The magnesium coatings also offer increased corrosion protection but carry higher overall costs which may be difficult to justify by most coated metal users. The unique corrosion benefits, low cost, and the relative ease of production made Galfan a perfect choice for The Techs. These same attributes also make it a perfect choice for many customers.

Galfan 101

The Galfan chemistry is a eutectic alloy, a specific ratio whose melting point is the lowest of any zinc aluminum composition. This 95% zinc / 5% aluminum combination (with mischmetal to aid adhesion) results in a microstructure in which the high zinc phase and high aluminum phase freeze into very thin alternating plates. This lamellar microstructure retards corrosion of zinc by interfering with its conversion to zinc oxide and zinc carbonate. As a result, Galfan coatings exhibit excellent barrier protection as well as superior cathodic cut-edge protection.

In addition, the aluminum level causes the alloy layer at the interface between the coating and steel to be very thin. This layer exhibits minimal micro-cracking when the material is bent or roll formed for an end-use

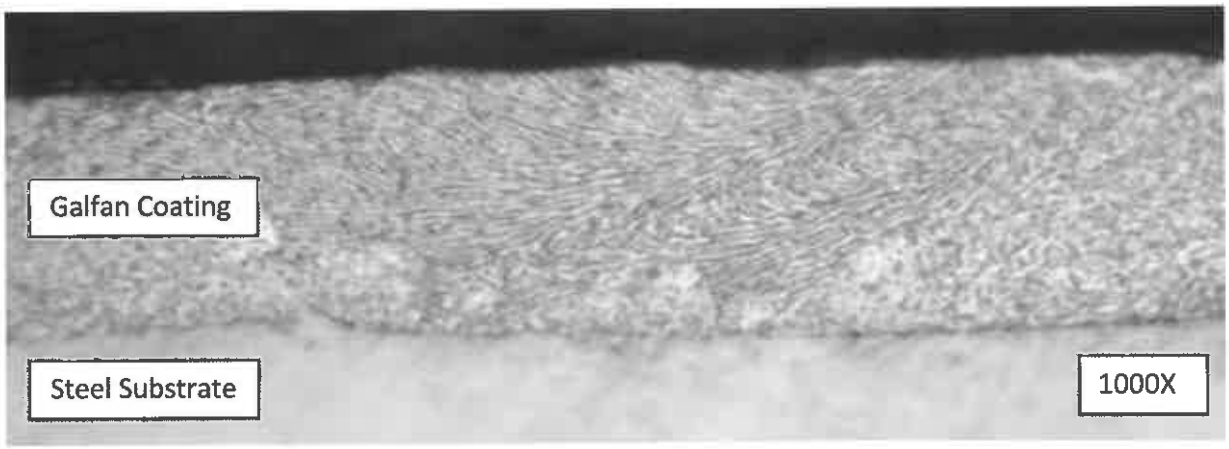


Table1

Coating	Chemistry	Density	Thickness	Coating Weight
Galvanized (ASTM A653)	99% zinc	0.2579 lb/in^3	1 oz/ft^2 = 0.00168"	G60=0.60 oz/ft^2 (0.00101")
Galfan (ASTM A875)	95% zinc, 5% aluminum w/ mischmetal	0.2379 lb/in^3	1 oz/ft^2 = 0.00175"	GF60=0.60 oz/ft^2 (0.00105")
Galvalume (ASTM A792)	55% aluminum, 43.5% zinc, 1.5% silicon	0.1356 lb/in^3	1 oz/ft^2 = 0.0032"	AZ55=0.55 oz/ft^2 (0.00176")

like building panel or roofing. Standard Galvanized exhibits zinc grain boundaries and a thicker alloy layer which is more susceptible to micro-cracking. To a greater extent, the zinc and aluminum in Galvalume solidify in different phases which can make the coating brittle and susceptible to corrosion attack on formed bends.

The added aluminum in the Galfan coating changes the density compared to 99% zinc; however, the difference is small enough that the coating thickness is not significantly changed. See table 1 for coating comparisons.

The coating chemistry also changes the surface appearance. Galfan does not have the traditional snowflake dendritic spangle; it has a smooth reflective surface with faint hexagonal boundaries. Picture 2 is an example of a typical Galfan appearance. The surface also has a lower coefficient of friction compared to Galvanized, which is an added benefit in deep drawing applications.

Corrosion Performance

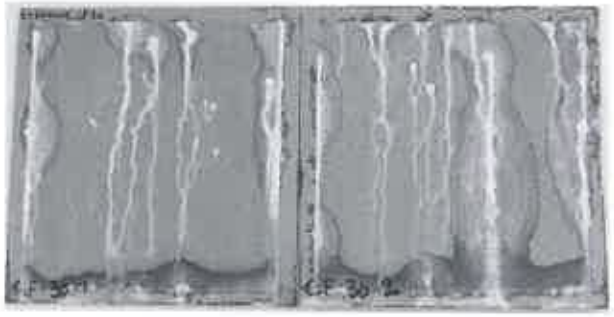
The Galfan chemistry and microstructure doubles the corrosion protection over that of standard Galvanized. While there have been numerous studies on this in the past, The Techs have conducted several salt spray comparison studies to obtain new data. These tests substantiate prior work showing that Galfan has at least double the corrosion (white rust) protection as Galvanized. See pictures 3 through 5. The unique microstructure acts to also slow the rate of red rust, improving the product's overall thickness and weight loss in corrosion tests. See chart 1.

Benefits

The alternative coating chemistry of Galfan provides unique benefits. Double the corrosion protection and the ability to achieve lower coating weights provide the coated metal consumer a sustainable product at lower costs. Additionally, the added aluminum in the zinc bath lowers the viscosity of the molten metal allowing for the production of lower coating thicknesses compared to conventional zinc-based coatings. Traditional Galvanized has a lower coating thickness limit of G30 (0.030 oz/ft2), while the viscosity of molten Galfan makes GF20 (0.20 oz/ft2) and potentially GF15 (0.15 oz/ft2) coatings possible. These lower coatings have been achieved at The Techs, but the high air volume needed to achieve GF15 brings added safety concerns, and is still under development.

The superior corrosion protection of Galfan versus Galvanized gives the steel purchaser a choice: cut the coating weight in half for the same protection, or maintain the same coating weight and double the corrosion protection to achieve a premium product. In either scenario, the costs to the steel purchaser are reduced. Even though Galfan introduces slightly higher raw material and production costs, there are still significant savings when coating weights are decreased (e.g., G90 to GF45). In addition, the total cost to double the corrosion protection (e.g., G90 to GF90) is only three to five percent higher, much less than simply doubling the Galvanized coating (e.g., G90 to G185).

Sustainability and green building require using



22304005 .0125" GF30 - 1008 hrs Salt Spray – ASTM B117

22311056 .0142" G60 - 1008 hrs Salt Spray – ASTM B117

12329031 .0688" GF45 - 1008 hrs Salt Spray - ASTM B117

12338019 .071" G90 – 1008 hrs Salt Spray -- ASTM B117

materials in the most productive way with an emphasis on using less. This is the hot topic of the day. Galfan coatings help achieve these goals by reducing both zinc usage and overall energy usage (lower operating zinc bath temperature) while providing an equivalent or superior coated product.

Coil Coating

Galfan is known to have excellent paint adhesion, especially due to its reduced micro-cracking on formed bends. As with all materials, adhesion is dependent on

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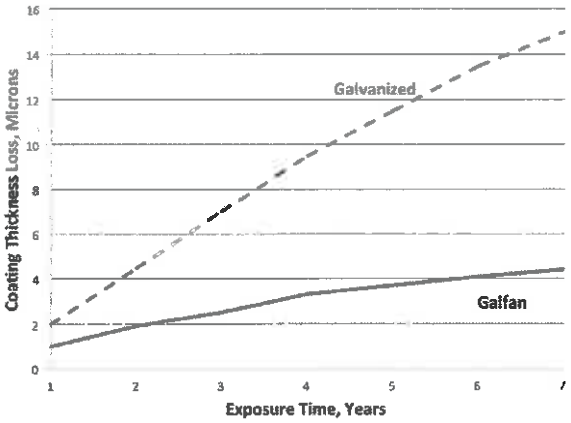

Source: Galfan Improved Galvanizing, Product Manual Volume I, Performance Section pg 9, New Zealand Steel Study

many factors including production parameters, transit protection, type of pretreatment, and the paint system itself. Dried-in-place chrome, chrome free and complex oxide pretreatments have been approved for use with Galfan coated material. Zinc phosphate pretreatments have performed well also, but there is a concern of increased aluminum concentration in the zinc phosphate bath from the higher aluminum in the Galfan coating. Therefore zinc phosphate pretreatments need further study before being utilized for extended paint runs.

Galfan product produced at The Techs has been painted at a growing number of coating lines and has performed very well. The majority of these products used chrome dried-in-place pretreatments with polyester paint systems. Corrosion testing was performed with very positive results. See picture 6.

Markets

Galfan is a great product, as are Galvanized and Galvalume. Each product has unique attributes that should be evaluated by the user. Galfan fills a need where the user desires to achieve similar corrosion protection at reduced coating weights, enhance the sustainability of the end product, or achieve greater corrosion protection for a small cost increase.

Because Galfan has had success in Europe and Canada, there are several established markets. Galfan is specified for many automotive applications, especially for deep-drawn unexposed parts. The Techs new domestic Galfan supply has been welcomed news to this market, which has been solely supplied by imports. Other current and potential markets include agricultural, such as animal confinement (painted and bare), metal framing, building panels, transportation, swimming pool walls and supports, fabricated metal products, and many interior building products such as lath and ceiling grid.

The interest in Galfan has grown over the last year in the United States. Many companies that were involved in the initial trials have steadily increased their participation, while others are just beginning to discover the value of Galfan. To find out how Galfan can benefit your business and for more information on The Techs and Steel Dynamics, Inc., visit www.TheTechs.com/GALFAN or email questions to GALFAN@TheTechs.com