NUMBER
17
MARCH
2013

INDUSTRIAL
GALVANIZERS
CORPORATION

Tech Tips

How ‘Green’ is hot-dip galvanized steel? Zinc as an environmentally sustainable coating material...

WHY GALVANIZE?

Hot dip galvanized coatings are applied to steel to improve the anti-corrosion performance of the steel to ensure that it lasts as long as possible with a minimum of maintenance

COATINGS DIFFER

Only hot-dip galvanizing gives a coating that can reach the 50 year life required of structural building products.

THICKNESS COUNTS

Compared to other zinc-rich coatings, hot-dipped galvanizing is:-

- THICKER
- HARDER
- FULLER

HOT-DIP GALVANIZED PRODUCTS LAST LONGER...

Zinc occurs naturally in earth and water. Its main use in galvanizing extends the life of steel, conserving resources.

Galvanizing - coating steel with zinc to provide corrosion protection - is the largest use of zinc metal accounting for over 50% of total consumption.

The issue of environmental sustainability is becoming increasingly significant at all levels of our society. It is not only on the political agenda as ‘green’ candidates represent an increasing proportion of the political landscape at local, state and federal level, but is also a high priority for the design professions and their clients in the 21st Century.

A simple method of rating materials is to compare them on the basis of their Gross Energy Requirements (GER). This accounts for all the energy used in mining, smelting, refining and forming the material. For metals in particular, another factor called Gibbs Free Energy (GFE) is a measure of the energy required to convert the ores to the metal. Nature always seeks equilibrium at the lowest energy levels and the GFE makes all metals intrinsically unstable.

Their stored energy constantly seeks an opportunity to get out. The GER and the GFE are not necessarily related. Some metals like copper have high GER requirements because of the nature of their ores, and low GFE requirements because of the nature of the material.

The following table illustrates this relationship:

Material	Mineral	GER (MJ/kg)	GFE (MJ/kg)
Aluminium	Al_2O_3	270	29.0
Copper	Cu_2S	115	0.7
Zinc	ZnS	70	3.0
Steel	Fe_2O_3	35	6.6
Lead	PbS	30	0.45

It can be seen from this table that in the context of protective coatings for steel, zinc has double the GER of steel but has less than half the GFE.

Zinc, when used as a component in a protective coating for steel is by its nature, sacrificial. All zinc used as a protective coating for steel will be returned to the environment as it oxidises or corrodes sacrificially to prevent corrosion of the steel. Protective coatings of all kinds work on the principle that a small amount of coating can protect a large amount of steel.

Industrial Galvanizers and its representatives have made reasonable efforts to ensure the accuracy of the information provided in this publication, but it does not constitute product advice. The information is of a general nature only and does not take into account your individual situation or needs. It should not be used, relied upon, or treated as a substitute for specific professional advice. Industrial Galvanizers recommend that you obtain your own independent professional advice before making any decision in relation to your particular requirements or circumstances.

INDUSTRIAL GALVANIZERS
A valmont COMPANY

How ‘Green’ is hot-dip galvanized steel? Zinc as an environmentally sustainable coating material...

TRIED & PROVEN

Over 40 years of field testing shows that galvanized coatings perform well even in harsh environments.

ZINC AND THE ENVIRONMENT

Zinc is a naturally occurring element that is vital for life. In its refined metallic form, zinc is predominantly used for galvanizing steel. By extending the life of steel products, galvanizing reduces resource usage for its replacement. Zinc corrosion products return to the environment where zinc compounds have a positive impact o n agriculture and the food chain.
At the end of service life, galvanized material can be recycled.

WHY GALVANIZE WITH INDUSTRIAL GALVANIZERS?

For steel users requiring fast, proven corrosion protection for local or national projects Industrial Galvanizers is the established hot dip galvanizer with nationwide coverage.

On hot dip galvanized products, for example, the galvanized coating mass is typically about 5% of the mass of the steel that it is protecting. If unprotected, the steel would corrode at rates typically 20 times faster than zinc. Using adequate protective coatings systems on steel to delay the escape of its Gibbs Free Energy as long as possible is thus a major factor in determining environmental sustainability.

Zinc as a sustainable material.

Compared to other base metals zinc occupies a favorable position as an environmentally sustainable material. Energy consumption for primary zinc production is 25-50% higher than that of steel and only about 20% of aluminium.

About 20% of zinc used is recovered as scrap and this is likely to increase to over 60% as recovery process technology improves.

The galvanizing of steel as sheet, wire, tube and fabrications offers very good corrosion resistance on steel and greatly increases its life. On average, about 70 kg of zinc (which consumes 250 kWh of energy to produce) is consumed to prolong the service life of 1 tonne of steel as sheet, which consumes about 2900 kWh of energy to produce, by a factor of between 3x and 5x. At the end of its service life, the galvanized material can still be recycled, except for the zinc lost through corrosion and run-off.

As weathering occurs with these zinc-based coatings, the zinc is consumed in two ways. These are:

- Oxidation of the zinc and physical removal of the zinc oxide products by washing or erosion.
- Electrochemical dissolution of the zinc adjacent to exposed steel when an electrolyte (water) is present.

These zinc corrosion products are transported into the surrounding environment. It is their impact in this context that determines their viability as coatings into the foreseeable future. The rate at which zinc moves into its surrounding environment from the weathering of coatings is obviously determined by coating life.

Zinc is a natural component of the earth’s crust and an inherent part of our environment. Zinc is present not only in rock and soil, but also in air, water and the biosphere.[#] Plants, animals and humans contain zinc - in fact it is beneficial to the prevention of a number of illnesses. Its positive impact on crop growth and yield sees zinc increasingly added to fertilizers.

[#] *International Zinc Association.*

A.C.N. 000 545 415

Registered Office:
11 Talavera Road,
Macquarie Park, NSW 2113

INDUSTRIAL GALVANIZERS (AUSTRALIA)

Townsville | Brisbane | Newcastle | Sydney | Port Kembla | Melbourne | Launceston | Perth

www.ingal.com.au www.valmont.com

A valmont COMPANY