"Galvanized steel can enhance vehicle body life"

Indian companies have now started using zinc coats on steel components, automobiles, and construction activities. It is a step in the right direction, says Kenneth de Souza, Consultant, International Zinc Association

Dr Kenneth de Souza is a metallurgical engineer and corrosion specialist with over 40 years of experience in the steel industry in Canada and the United Kingdom. He specialized in the production, testing and stamping performance of metallic and organic coated steel. He was responsible for developing products, specifications and introducing several new coated steels for the construction and automotive market in North America. As consultant to the International Zinc Association, he was in India recently. He speaks to C&ACER about the use of zinc in protecting steel from corrosion.

How does zinc help in protecting steel from corrosion?

One of zinc's most exceptional qualities is its natural capacity to protect steel from corrosion. When left unprotected, steel will corrode in almost any environment. Zinc coatings protect steel by providing a physical barrier as well as sacrificial protection for the underlying steel.

Zinc coatings provide a continuous, impervious metallic barrier that prevents moisture from contacting steel. Without direct moisture contact, there is no corrosion. However, since zinc gradually corrodes due to its much slower degradation in the presence of water and atmospheric pollutants in open air applications, barrier life is proportional to coating thickness. This subject has been researched for many years and the literature is well supplied with reports on zinc's performance in different climates, with different alloy additions to the coating and at different coating thicknesses. The application of paint over the zinc coating, known as a duplex system, can also extend barrier coating longevity.

Another outstanding protection mechanism is zinc's remarkable ability to galvanically protect steel. When bare steel is exposed to moisture, such as at a cut edge or surface scratch, steel is protected by the sacrificial loss of zinc in the vicinity of the exposed steel. In the immediate presence of zinc, steel will not corrode until all the zinc has been sacrificed. This is particularly important for coated steel sheet since corrosion will continually undercut both aluminum or paint barrier coatings.

The presence of zinc is the key to cathodic,or sacrificial protection. All zinc-containing metallic coatings, including zinc-rich paints, share this beneficial characteristic.

How relevant is the use of zinc coatings in India?

Indian companies have now started using zinc coating on steel components, automobiles and construction activities with galvanized rebars. It is a step in the right direction. With zinc, the life of steel can be extended by several orders of magnitude. For example, hot dip galvanized steel can provide corrosion protection for over 75 years depending on the thickness of the zinc coating. This is very relevant for India's infrastructure development because of its 8,000 km marine coastline.

Can you tell us something about the advantages of this new process i.e. the Continuously Galvanize Reinforcing (CGR) bar?

Reinforcing steel is used throughout the world in concrete structures of every kind. Different methods have been developed to protect the reinforcing steel. Galvanized steel; epoxy coated steel; low stainless steel and hot dipped galvanized steel bar. A new process has been developed recently to Continuously Galvanize Reinforcing bar (CGR). The CGR Rebar process is a hot dip process and has some advantages over conventional hot dipping. CGR involves running a continuous thread of reinforcing bar through a zinc bath. The steel is immersed in the zinc for only a few seconds therefore eliminating the risk of any change to the metallurgical structure of the steel in question. Another advantage is there is no limit to the length of the bar that can be continuously dipped. The treated steel can be supplied

Dr Kenneth de Souza

in rolls. The coils of steel can be formed into almost any shape at the construction site. This provides great flexibility and reduces transport costs from preforming suppliers.

This system is already in use in the United States and China and should come into India soon.

What do you feel about the role of galvanizing in the Indian automotive market?

Global car makers offer an anti perforation warranty for 12 years. Though India has started using galvanized or galvanneal steel for body panels of cars, they are implemented only in export models. Unfortunately, domestic cars are non-galvanized. The overall benefit to the automaker to convert the 400 kilogram car body-in-white from cold rolled steel to galvanneal is estimated to offset the material and processing cost. Galvanization also brings down the cost of maintenance passing down benefits to the end users.

Indian roads too should soon have cars with perforation warranties once the Bureau of Indian Standard (BIS) standardizes the specifications of the steel used in automotive industry.

IZA is working with BIS to finalize a standard that brings India to the level of global players in terms of using galvanized steel for automobiles. We have submitted a draft to the Bureau with specifications and BIS is reviewing it. In the process, all the car companies have to mandatorily use the approved material in their cars.

Galvanizing is a controlled coating of zinc on steel in order to protect it from corrosion. The zinc sacrifices itself slowly but steadily to protect the strength and safety of steel in the automobile body. The process apart from improving the safety of the car, leads to weight reduction which in turn reduces emission.

A survey conducted by IIT Bombay last year revealed that almost 60 percent of cars suffer from corrosion effects like rust, blisters and perforation. It also found that galvanized cars show significantly improved performance by 60%-70% as compared to non-galvanized cars of the same model.

Similarly, I have heard that IZA is requesting the Indian Railways to go in for galvanized tracks. How will this help?

Indian Railways is looking to extend the life of rail tracks by galvanizing the web and bottom flange using a process called "thermal spraying." This will avoid losses arising out of frequent track replacement from corrosion. Corrosion of rails causes huge economic loss because of frequent rail replacements. Rail failures due to corrosion affect the safety of commuters and disturb normal traffic. Zinc coating of railway tracks would not only be significant initiative towards safety of trains but would also give more life to the railway tracks. Indian Railways requires corrosion-free tracks as the railways are considering the Bullet Trains. The entire change would not only be cost effective but India would also be the first country to initiate such step towards passenger safety.

PHOTO: 123RF

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According to a study conducted by IIT Kanpur and the Steel Authority of India Limited, large funds are invested to upgrade and maintain the railway track system in India. One of the significant aspects of railway track maintenance is the detection of corrosion and the replacement of corroded rails.

The economic cost due to corrosion of rails is very significant. The rails have a life of 800 gross million tons, which works out to approximately 12-13 years under normal traffic conditions in India. Corrosion reduces the life of rail to nearly half its expected life.

How does zinc coated steel sheet save on energy costs?

PHOTO: 123RF

Several studies have shown cool roof steel roofing to outperform other construction materials in reducing energy costs.

The use of cool roof paint technology applied over zinc coated sheet steel has demonstrated significant energy savings during the cooling and heating seasons. Several studies have shown cool roof steel roofing to outperform other construction materials in reducing energy costs. There is a huge potential for using this available paint technology in India for roofing and cladding applications.

Is there any system wherein one can determine how much is the life cycle costs for zinc based protection systems?

We are in the process of developing a program to calculate life cycle costs for different zinc based protection systems such as thermal sprayed zinc, organic coatings and duplex systems of paint supplied over thermal-sprayed zinc, across five locations in India. With this study, we will be able to determine how much zinc is lost during a given time. This study can help us create better designs since the decision making process will then be data-based, rather than ad hoc. The study will also reveal how long does the pre-paint keep its gloss in different locations, the effect of ultra violet rays, the effect of dirt and how much heat is trapped, etc.