RECENT TECHNOLOGY & MARKET TRENDS IN GALVANIZING

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INTRODUCTION:

Hot dip galvanizing is versatile and the most preferred method for prevention of corrosion of iron and steel. On an average, about 65 to 75% of the Zinc consumed in any country goes only in the galvanizing sector. The process has remained, by and large, a manual-oriented process in GENERAL GALVANIZING with improvements in furnace designs, materials handling etc., It is only in the CONTINUOUS GALVANIZING processes for sheets, wires etc, major improvements have taken place not only in the process but also in the usage of the product in areas hitherto unknown.

I. GALVANIZING REACTIVE STEELS

(a)TECHNIGALVA

It is unusual for an industry to fund research with the intention of reducing the consumption of its products. However, that happened in the early 80s when European zinc producers formed a research club to explore the possibility of bringing nickel additions to general galvanizing baths into commercial use. The result was a product with the trade name **`Technigalva'**, which has now been in common use in the UK for over a decade. Technigalva was introduced to the market in response to changes in steel making processes which had increased the incidence of unattractive coatings, and to satisfy the need for an improvement in quality for the more discerning market place.

Since the 40's the steel industry has been making silicon additions to deoxidise steel prior to casting. Sandelin was first to report the harmful effects of residual silicon on the galvanizing properties of these steels. He derived a plot of reactivity versus silicon content which became the standard explanation for high galvanizing reactivity and the basis of further research on the problem [1] Nickel, chromium, manganese and vanadium were shown to be able to counteract the harmful effects of silicon and this formed the basis of the Technigalva project. It was found that by introducing up to 0.2% Ni into the zinc bath the dull, thick and sometimes poorly adherent coatings on silicon-rich steels could be replaced by thinner with normal finish, typical of those on low silicon materials.

Conversion of galvanizing baths to Technigalva, and the replenishing of their nickel contents after a period of use, requires the addition of a nickel-rich master alloy. In the UK Technigalva has always been supplied by Brittania as a 2% Ni master alloy in bundles of 25Kg plates. In the UK today 43 galvanizing baths are operating using the 2% master alloy method. This represents over 45% of the UK operating baths and a considerably higher percentage in tonnage terms. Technigalva has also started making a beginning in India in several tube and general galvanizing plants.

(b) GALFAN

Galfan is a zinc 5% aluminium alloy with a misch metal addition that, when applied as a coating on steel, offers an improvement over the performance of galvanized steel. Galfan coated steel provides greater corrosion resistance, enhanced formability and paintability when compared to galvanized coatings. The diversity of end use products made from Galfan coated steel continues to grow with recognition of the benefits of Galfan. Galfan coated sheet continues to provide an increasingly accepted alternative to galvanized material for a range of applications.

The results of exposure tests carried out in Germany confirm that Galfan coatings have lower corrosion rates than galvanized coatings on flat, roll formed, cut and scored sheets in several different environments.

Worldwide, more than 2 millions tonnes of galvanized coated products (sheets, wires etc.,) are produced currently. A few Indian companies evinced interest in becoming Galfan licences.

II (a) GALVANIZED STEEL REINFORCEMENT

To counter the problems of distress in RCC structures, various coatings were tried on the reinforcement steel to determine their efficacies. In view of the metallurgically-bonded coating that is well-adherent to the base steel, galvanized reinforcement rods are being used very widely in bridge decks, highways, submerged structures, process industries, coastal locations etc., Countries like USA, Japan, Australia, UK provide a very large number of applications using galvanized reinforcement steel. In many countries where such steels were used 2 or 3 decades ago, there was no need for maintenance in between and such structures do indicate a further period of maintenance free life for several more years.

(b). GALVANIZED SHEETS IN APPLIANCE INDUSTRY

The expansion of coated steel products in the appliance market in recent years is determined to a large extent by their ability to meet the basic requirements of the appliance industry. These are cost reduction, improved product performance and environmental compatibility, including waste management during manufacture and total recycling concepts.

The highest percentages of coated product utlisation are observed in UK, France and Denmark. Hot dip galvanizing is the main coated product all over Europe; an exception to this rule is found only in UK and Denmark; Electrogalvanized and organic coated steel prevail there.

Coated steel sheet consumption in white goods by the European appliance industry amounts to about 500000t/y, which represents around 50 per cent of the total steel sheet consumption.

Hot dip galvanized steel accounts for around 250000 t/y or 50 per cent of the present total coated product usage for this market.

A future trend indicates:

* Slight increase in hot dip galvanizing usage for appliance cost reduction and especially in the top-class, improved corrosion resistance.

* Stagnant or slightly decreasing consumption of Electrogalvanizing.

III. ZINC AND HUMAN HEALTH

Zinc is an essential trace mineral nutrient required for the maintenance of human health. However, as with all substances, adverse health impacts can be associated with excessive exposures to Zinc. As a result, concerns have been expressed over possible adverse human health effects which may be associated with environmental dispersion of zinc as a consequence of industrial practices and/or environmental contamination resulting from normal product usage.

Zinc is also an essential trace mineral nutrient for terrestrial and aquatic organisms. However, concerns have been expressed that diffused sources of zinc in the environment can result in concentrations of zinc in soil or water which have adverse impacts upon aquatic and/or terristrial ecosystems. As is the case for human health, issues associated with potential environmental impacts of zinc must be reviewed with recognition of (1) the natural presence of zinc in the environment; (2) the geochemical factors which modulate the bioavailability of zinc in the environment and; (3) zinc's role as an essential trace mineral nutrient.

The US regulation recommends specified levels of dietary allowances of Zinc per day for men pregnant mothers and children.

ZINC AND THE ENVIRONMENT

Recent years have witnessed growing concern over the presence of

heavy metals in the environment. Zinc, along with other metals has come under scrutiny as an environmental contaminant. Toxicologists have attempted to determine the ways in which exposure to excess zinc can be harmful to human health, while environmental scientists have focused upon the potential toxic effects of zinc upon plants, fish, earthworms and microscopic organisms.
Zinc has ocassionally been the focus of well-intentioned public policy seeking to provide protection for people and their environment.

When concerns are expressed over zinc toxicity, the public generally does not recognize that, for a toxicologist, everything is toxic water, salt, sugar cocoa - all are toxic substances capable of causing harm and even death. However, the doses required to produce toxicity from these everyday substances are far beyond those encountered in normal human experience. In the specific case of zinc, normal human experience does not confront us with environmental zinc as a threat to human health. In fact, quite the opposite is true.

The International Programme on Chemical Safety (IPCS) convened a Task Group meeting in Australia in September 1996 to review, revise and finalize the new IPCS Environmental Health Criteria (EHC) Document for Zinc.

The conclusions of the Task Group pertaining to environmental issues were as follows:-

* Zinc is an essential element in the environment. The possibility exists for both a deficiency and excess of this metal. For this reason, it is important that regulatory criteria for zinc, while protecting against toxicity are not set so low as to drive zinc levels into the deficiency area.

* There are differences in responses to deficiency as compared to excess.

* Both biotic and abiotic factors control zinc bioavailibility. For instance, organism age and size, prior history of exposure, water hardness, pH, dissolved organic carbon, temperature etc.,

* The total concentration of an essential element such as zinc, alone is not a good predictor of its bioavailibility or toxicity.

* There is a range of optimum concentrations for essential elements such as zinc.

* The toxicity of zinc will depend on environmental conditions and habitat types. Thus, any risk assessment of the potential effects of zinc on organisms must take into account the local environmental conditions.