## **GALVANIZING INDUSTRIES IN INDIA - PRESENT SCENARIO**

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India ranks 9th in the production of zinc. With commissioning of the Rampura-Agucha-Chanderiya integrated of HZL in 1991-92, the country has achieved near project self-sufficiency in zinc. The zinc consuming industries in India have come of age in the matter of selection and use of different grades of zinc. All the commercial grades of zinc i.e. special high grade, high grade and P/W /GOB grade available in the country. They are used by are the galvanizers as per their bath composition requirements. Zinc consumption in India has grown from 60,000 tonnes in 60-61 230,000 tonnes in 95-96. The present zinc consumption to trend shows that galvanizing sector accounts for more than 70% of total zinc consumed. Of this amount, the is in sheet/strip, 60% in tube, approximately 20% 15% in structurals and general, and 5% in wire galvanizing units.

With the deregulation liberalisation and economic reforms environment is very conducive for foreign as well the 25 Indian investments in the galvanizing sector. The changes in trade and industrial policies are favourable for existing prospective entrepreneurs planning to upgrade, expand and setup new galvanizing plants with state of the art and facility for higher production and productivity to be cost quality competitive in internal and global market. and

The process in hot-dip galvanizing, be it continuous sheet/wire line, semimechanised tube/pipe line or batch process, may be grouped into three major sections consisting of steel surface preparation, hot dip coating and post treatments. The surface preparation section may include cleaning, rinsing, pickling, rinsing and deoxidizing by thermal or chemical (fluxing) methods. The hot dip galvanizing section may consist of preheating (in fluxing lines) or cooling (thermal lines) the steel, immersion in the molten bath, thickness control and cooling. The surface treatment section may consist of three main processes i.e minimizing (grain size), smoothing the surafce and passivating. The grades of zinc generally used are PW/ GOB grade/high grade or special high grade. The present trend is more towards the use of PW zinc containing about 1.25% lead either fully or partially, depending on the tolerance for lead contamination in molten zinc. Except the continuous sheet galvanizers, other galvanizers maintain a molten lead layer at the bottom of zinc bath to make the dross removal easy. There are also lead-zinc baths used in continuous sheet galvanizing. Continuous galvanizing line units for GP/GC sheets have equipments with better design and layout to maintain a continuous production.

To begin with, sheet galvanizing was a sheet by sheet galvanizing process. The introduction of cold-reduced coil in the United States in 1926 led to demands for continuous galvanizing facilities, the product either being cut at the end of the line, corrugated, profiled or plain or recoiled for shipment. Various types of galvanizing lines have come up since then, the first being the Sendzimir type introduced in 1936. The strip cleaning, annealing, galvanizing, coating thickness and texture controls have undergone a sea change since then with the introduction of processes such as US Steel, Wheeling, Non-ox, Selas and Stein-Heurtey. Now better, safe and economical furnace designs with improved heating systems are available for annealing the strips.

Unprecedented developments have also taken place in the quality and range of steels for galvanizing and the coatings. New ranges of aluminium killed steels produced by continuous casting technologies are now avilable for galvanizing with reduced aging and of deep drawing quality, suitable for forming and drawing operations required for automotive industries. 1980s saw the appearnce of Interstitial free steels (IFS) (no more aging) and of extra deep Drawing Qualities and late 80s-early 90s, of Bake Hardeninng steels and of Rephosporized steels (all steels used in automotive applications). With this, now there is a world wide wave to produce automotive grade of galvanized sheets with perfect surface quality. A new plant concept for hot dip galvanizing lines with automation is developing in recent years.

Considerable efforts have been made in recent years to improve the characteristics of galvanized coatings,

particularly corrosion resistance, formability, paintability, weldabilty etc. Additions of various alloying elements to the bath were proposed of which Al, Mg, Cu and Cr seemed particularly interesting. The research work carried out in different laboratories resulted in the development of coatings with high aluminium content such as Galvalume (55% Al-1.2% Si), low aluminium content (5% Al, eutectic) with the addition of mischmetals such as Galfan, and medium aluminium content (30% Al) with the additions of 0.2% Mg and 0.2% Si, such as Lavegal. All these coating alloys aim to combine the advantages of the conventional zinc and aluminium coatings.

The Zn-55% Al-1.5% Si alloy coating, known as Galvalume, Zincalume, Aluzinc, Aluzink, Algafort, Alugalva or Zalutite according to seven of the main producers, is in principle applicable to other forms of steel as well as sheet. In practice, however, it is only the sheet development which has been commercially developed and annual production is over 1,000,000 tons - substantial but still small compared with over 20,000,000 tons per year of galvanized sheet. The coating has a two-phase microstructure and has high corrosion resistance when coating is not damaged. But it suffers from the disadvantages of lack of adequate sacrificial protection, formability and weldability.

The Zn-5% Al types of alloy coatings have been developed more recently but are showing substantial growth prospects.

Initiated by the International Lead Zinc Research Organization, over 100 companies worldwide have taken licences. The coating can achieve 2.5 times the corrosion resistance of galvanized steel with good paintability and formability without losing the main electrochemical and joining properties of galvanized steel.

It seems likely that the 5% Al and 55% Al containing zinc alloy and conventional galvanizing will develop in parallel for coating sheet as each has some special properties for taking niche markets. The family of coatings will between themselves provide more of the properties demanded by users and their share of the total market should increase.

Most of the sheet galvanizers in India have better laid out plant for continuous galvanizing of coils with foreign collaboration and have imported plant and technology. Some of these plants have continuous oxidising and reducing furnace for pretreatment instead of conventional pretreatment section. Some use airjet wiping to ensure uniform surface finish and coating thickness as per specification while others have roller wiping. There are a few sheet by sheet galvanizers using conventional galvanizing process. There are about 40 sheets/strips galvanizers in India. The bulk of the production is of thin gauge galvanized sheets with thickness ranging from 0.15mm to 1.6 mm. Width of sheets range from 650mm to 1220 mm.

Today's high speed lines are sophisticated with high degree of automation, on-line coating thickness measurement, computer based data acquusion and control, etc. They are capable of producing a wide range of product sizes, coating types, thicknesses, finishes etc. Attempts aimed at improving the surface characteristics, weldability, formability and paintability of these sheets have resulted in the development of mini spangle, spangle free ultra smooth surface, monogal, differentially coated and galvannealed sheets. Spangles are controlled either using chilling techniques like use of water cooled chill rolls, steam impingement, spraying zinc dust (Heurtey process) etc or by annealing called galvannealing. One sided galanized coatings is produced by various techniques like Armco meniscus method, masking method, and Monogal differential coating method. Zinc coating thickness in galvanized sheets is controlled by steel rolls in the older lines, and air/steam or nitrogen jets.

As a result of these developments, in a relatively short time, galvanized sheets have received universal acceptance and extensive usage. It is expected that within a short span of time the indegenous auto makers, appliances manufacturers and coil coating industry also become intersted in galvanized sheets.

Within the last ten years the painting and plastic coating of galvanized strip/sheet has grown into a major industry and should continue to expand rapidly. First developed in

the USA and Japan, the plants are now being installed in many contries, notably in Western Europe. The first major continuous painting line for steel was installed at Gorseinon in 1965.

In fact, when a suitable protective paint system is applied over a properly prepared hot-dip galvanized surface, an unexpectedly synergic improvement in corrosion resistance is observed. Duplex systems, as they are called, require minimum maintenance, during the useful lifetime of steel structures. Also, when a definite colour is required on a steel structure for aesthetic reasons, traffic conditions, environmental demands, or military needs (such as camouflage), a duplex system offers the best combination of pleasing appearance and protection against corrosion. The economics of the combined system would be most favourable if the oraganic coating are applied while the galvanized steel is still in continuous form.

Tube galvanizers have automatic system except the extraction of pipe after hot dipping which is manually done. There are about 100 units manufacturing welded steel pipes and tubes with a licensed capacity of 35.59 lakh tonnes per annum. Majority of these units are engaged in the manufacture of galvanizedpipes for irrigation, rural and urban water supply, sewage and other applications. It is estimated that about two-thirds of total pipes and tubes produced in the country are galvanized. Pipe manufactured,

come in three classes-light (Class A), medium (Class B) and heavy (Class C). Nominal bore of the pipes range from 15mm to 200 mm.

Wire galvanizers have continuous galvanizing lines with facilities to galvanize multiple strands of wires. There are about 70 manufacturers of galvanized steel wires with an estimated production capacity of about 200,000 tonnes per annum. some important applications of G.I. wires are in the manufacture of wire ropes, barbed wire for fencing, core wire of ACSR etc. Production of galvanized wires of various gauges is estimated to be about 120,000 tonnes.

In "General" or "Batch" galvanizing, both wet and dry galvanizing processes are in practice. Some galvanizers use combination i.e. wet and dry both. There are about 80 "Structural / General" galvanizers with a total production capacity of more than 4.5 lakh tonnes per annum. Their major items of production are transmission line towers, telecommunication towers component steel sections / fabrications, railway electrification structures / sections, forgings, fasteners and other steel structural components. Waste treatment from the galvanizing units is a matter of concern for the industry. Until the early 50's the problem of waste disposal was not very serious and urgent for galvanizers. It was frequently the practice to dischage waste liquors untreated into a drain or river. With the metal finishing industry greatly expanding this practice can no longer be tolerated because of the large

volume of harmful wastes being generated all over the world. Many countries have strict regulations governing the disharge of acid and heavy metal bearing solutions. Glavanizing plants are now facing upto the challange and are introducing effluent treatment and recycling units along with other pollution control measures.

Galvanizing industry has more than 150 years of history. During this time the effectiveness of galvanizing as a corrosion protection has been peroven. However, in recent years due to misinformation doubts have been cast to the. very usability of zinc regarding it as harmful to the environment. Zinc is classified among heavy metals. The toxic nature of lead, cadmium and mercury is well known. But zinc and some metals are essential to life. The campaign of maligning zinc has to be countered only through joint co-ordinated action by all of zinc users, product manufacturers and galvanizers who consume 70% of zinc. Communicating the positive aspects of zinc to the public and to the quarters that matter in making law is urgent. Implementing good house keeping will help public support. Galvanizing industry has a strong case. But it should act in a co-ordinated way proactively.