

# CR, Galvanized and Colour Coated Steel Industry in India - An overview

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Cold rolled and galvanized steel products play a vital role in a country's industrial development. Globally, the consumption of these products is estimated at 18 percent of the total finished steel consumption while in India the same was about 14 percent in 2004-05. Global export of cold rolled and galvanized products together was about 44 percent of the total export of flat products while in India the same accounted for about 37 percent in 2004-05.

Cold rolled and galvanized steel products together had a share over 39 percent of total flat product output and a share of about 26.4 percent in the total flat product consumption in India during 2004-05/

## Cold rolled product scenario in India

Cold rolled steel sheets / coils / strips are produced in India in various dimensions, dimensional tolerances with regards to thickness, flatness, width, surface finishes, numerous metallurgical designations like commercial quality, drawing / deep-drawing / extra deep-drawing variety and so on. These products are required with specified chemistry coupled with surface treatment with special cleanliness, dry lube or suitably oiled to meet the application requirements. These steels are produced with controlled sheet thickness, flatness and surface finish as well as metallurgically designed to provide attributes like high formability, deep drawability high strength, dent resistance, enamelability, paintability,

## Market segments for cold rolled products

- (a) Automobiles: Other skin panels, inner critical components, reinforcements and under body components.
- (b) Appliances: White goods especially, refrigerator doors, side panels, washing machine body and side panels and microwaves
- (c) Electric Panels: Switch gear cabinets, computers, electric equipment etc.

(d) Engineering: Tubes, pollution control equipment, motors, transformers, ventilation and air-conditioning ducts, cold formed sections for various applications

(e) Packaging : Drums, barrels, containers etc.

(f) Furniture: Admirals, Chains, various office and domestic furniture components

## Capacity of wide width CR products

The capacities of the wide width CR producers are given below :

Producers	Annual Capacity ('000 tonnes)
Rourkela Steel Plant	433
Bokaro Steel Plant	1390
Tata Steel	800
Ispat Industries Ltd.	350
Steelco Gujarat	200
TCIL	120
JISCO, Tarapur, Vasind	600
Special Strips, Vasind	125
Uttam Galva Ltd., Khopoli	500
Bhushan Ltd, Sahibabad, Kulkata	1000
Llyods Steel Ltd., Wardha	350
Shree Pre-Coated Steels Ltd.	600
Comet Steel Ltd., Nanded	145
Jai Corpn. (Sipta Coated Div), Nanded	62
Raymond Steel Ltd. Nasik	200
Tube Products of India Ltd., Chennai	100
Sidharta Tubes Ltd., Indore	100
Ferro-Concrete Ltd., Indore	120
Shri Vishnupriya Inds., Porynam	200
National Steels Ltd., Indore	150
Ruchi Strips Ltd., Indore	100
Jawahar Metal Inds., Sahibabad	100
Essar Steel Ltd., Hazira	1200

Besides the above, wide-width CR producers, there are a number of narrow-width producers of CR sheets and

coils which produce material in the width-range of 150 to 650 / 760 mm and usually have an annual capacity between 50,000 tonnes to 80,000 tonnes. Among these notable ones are Nagarjuna Steels Ltd., Hyderabad, Mohta Electro Steels Ltd., Bhiwani, Atma Steels, Ludhiana, Atma Steels Ltd., Gaziabad, Surya Roshni Ltd., Bhahadurgarh, Hero Cycles, Ludhiana etc.

### Consumption pattern of CR products in India

The broad sector wise consumption pattern of cold rolled products are shown below :

Consuming Sector	% share of Consumption
Coated Coils and Sheets	25
Auto / Tractor	24
Cycle Industry	11
Drums / Barrels / Container	11
Household / Office Furniture	7
White Goods	8
Precision Tubes	6
Gen. Engg / Construction etc.	8
Total	100

### Production CR sheets / coils in India ('000 tonnes)

Production of cold rolled sheets and coils in India between 1997-98 and 2004-05 are shown in Table – 1

The high growth in production of CR products in 1999-2000 was due to a hike in production by the secondary producers which rose by 635,000 tonnes or 28.45 percent over the previous year. The production of the ISPs also rose by 13.22 percent over the previous year as a result of higher production by SAIL's Rourkela and Bokaro steel plants which rose by 20,900 tonnes and 103,200 tonnes in 1999-2000 respectively over the preceding year.

The low growth rate in 2004-05 was due to a depressed growth of 4.53 percent in the production by secondary producers as against a healthy growth of 13.19 percent in the previous year.

### Import export of CR products

The import and export figures of CR sheets / coils by India is furnished in Table – 2

It is evident from the above table that import of CR products showed a downward trend between 1999-2000 and 2001-02 but it went up in 2002-03, again declined in 2003-04 and increased in 2004-05. The imports continued to have a high share of defectives.

Exports of CR products showed a continuous growth and

Table –1 : Production of CR sheets coils in India (000 tonnes)

Year	ISPs	Secy. Prod.	Total	Y-O-Y growth (%)
1997-98	1060	1935	2905	-
1998-99	938	2232	3170	5.84
1999-2000	1062	2867	3929	23.94
2000-01	1384	2806	4190	6.64
2001-02	1552	3096	4648	10.93
2002-03	1766	3275	5041	8.46
2003-04	176	3707	5475	8.61
2004-05 (P)	1843	3875	5718	4.43

Data source : JPC (P) = Provisional. ISPs = Integrated Steel Plants

India became a net exporter of these products since 2001-02. In 2004-05, India exported about 22.21 percent of her total domestic production of CR sheets / coils. The export of 1.27 Mt in 2004-05 was the highest among all finished steel products.

Table – 2 : Import & export of CR sheets / coils ('000 tonnes)

Year	Import	Export
1999-2000	288	161
2000-01	246	195
2001-02	204	320
2002-03	302	574
2003-04	243	770
2004-05 (P)	330	1270

Data source : JPC (P) = Provisional

### Demand and apparent consumption

The estimated demand and apparent consumption figures for CR sheets / coils in India are shown in Table – 3.

In 2000-01, the estimated demand was increased by 200,000 tonnes but the apparent consumption dropped by 160,000 tonnes. The demand was brought down by 50,000 tonnes in 2001-02 and was maintained at the same level of 3.25 Mt next year. In 2003 – 04, the demand was increased by 130,000 tonnes but apparent consumption went down by 190,000 tonnes. In 2004-05 apparent consumption declined by 11.5 per cent over the previous year indicating a slow down in the domestic market for cold rolled products.

### Features of some major CR mills in India

Rourkela Steel Plant (RSP) - The CR mill of RSP has one 1420 mm 5 stand tandem cold mill and a 1220 mm turn stand temper mill. It produces CR sheets / coils in the thickness range of 0.35 mm and width up to 920 mm to 1.85 mm thickness with width upto 1270 mm. RSP



Table – 3 : Estimated Demand & Apparent consumption of cold rolled products in India ('000 tonnes)

Year	Estd. Demand (D)	App. Consumption (AC)	AC as % of D
1999-2000	3100	3078	99.29
2000-01	3300	2918	88.42
2001-02	3250	3086	94.95
2002-03	3250	3202	98.52
2003-04	3380	3012	89.11

Data Source : JPC

produces grades like IS 513 / 94 Grade O.D.

**Bokaro Steel Plant (BSL)** – The CR mill of BSL has a 1420 mm 5-stand tandem mill, a 1420 mm HCL pickling line, a 1040 continuous annealing line, 92 annealing bases, three CR sheet shearing line. While BSL's tandem mill #1 has an electromagnetic gauge control system, tandem mill #2 has sophisticated gauge control system. The CR mill of BSL produces CR coils from 0.27 mm thickness (width up to 920 mm) to 2 mm thickness (width up to 1620mm). BSL is producing IS : 513 – 94 grade O.D., DD, EDD grades, IRSM – 41, SAILRIM, HSCRI & II and corrosion resistant capacity including a 50,000 tpy colour coating line.

**Tata Steel** – Its CRM complex has a 5 – stand 6 Hi tandem mill supplied by Hitachi of Japan and a 6-Hi UCM, automated gauge and shape control thickness tolerance of  $\pm 5\%$ , flatness 101 units in blanking. The CR mill has also a single stand 4-Hi skin pass mill electro discharge texturing machine supplied by 1H1 of Japan and UK which provides flatness of 81 units, uniform finish of end products, metal, bright and mirror finish. Tata Steel produces CR coils in the thickness range of 0.40 mm (with width up to 1270 mm) to 3mm (with width up to 1540mm). Tata steel has branded its CR products as Tata Steelemium which has been recognized as one of the best in the world.

**Ispat Industries Ltd.** – Ispat's cold rolling mill at Kalmeswar near Nagpur was the first modern and highly advanced one to be set up in India in combination mill with state-of-the-art technology produces D, DD and EDD qualities. The mill complex operates two types of CR mills 6-Hi and 4-Hi. The 6-Hi mill can achieve a reduction up to 0.13 mm while the 4-Hi mill can reduce thickness down to 0.25 mm. The CRM complex of Ispat has continuous pickling line, electrolytic cleaning line, skin pass mill, batch annealing furnaces etc.

**Bhushan Steel & Strips (BSSL)** – BSSL's CR Mill at Sahibabad near Delhi was installed in collaboration with the world leader in annealing technology, EBNER of Austria.

Its 6-Hi universal crown mill (UCM) has been supplied Hitachi of Japan. The process know-how is from Sumitomo of Japan with features like auto shape control and can roll 1600 mm wide strip for automobile and what goods sector. The mill produces drawing deep drawing and extra deep drawing qualities. BSSL is a major supplier of CR products to the Indian automobile industry.

**Uttam Galva Steel Ltd. (UGSL)** – It has three CR mills at Khopoli – a 20 CR mill of 50,000 tpy capacity, a 6-Hi mill and a 4-Hi mill with capacities of one lakh tonnes per year each

with technology provided by world majors. These mills are producing DD and EDD grades for the auto and white goods sectors.

**Shree Precoated Steels Ltd. (SPSL)** – Its first 4-Hi reversing mill of 130,000 tpy capacity came up in 2000 in another similar mill was installed by Hitachi of Japan in 2003 of 120,000 tpy capacity. Its third 4-Hi reversing mill of highest rolling speed was scheduled (of 350,000 tpy) to be commissioned in April 2005 in collaboration with a consortium of ACHENBACH and Mill Tech of Germany and Siemens etc.

### Galvanized steel products

Zinc coated galvanized GP and GC steel products are sturdy, light weight, bright and corrosion resistant. The functions of the zinc layer are mainly three folds:

- To retain the steel intact with its full initial strength
- To provide the surface a more pleasing appearance
- To increase the life of any suitable organic finishing system applied over it

In fact, zinc coatings provide the most effective and economic way of protecting steel against corrosion which has been estimated to cost an industrially developed country's economy at least 4 percent of its GDP every years.

Zinc coated steel is very environment friendly. Zinc is an integral part of our environment and occurs naturally in rocks, soil, air and water. Zinc is also an essential element for all life, from humans and animals to plants and micro – organisms.

All types of zinc coated steel products are recyclable. In the last few decades, both the recycling technology and its capacity has been developed considerably in response to increasing environmental awareness and the cost-effective alternative supplies of raw materials for the steel and zinc industries.

Presently, about 80 percent of the zinc is available from zinc coated steel that is recycled in India.

## Galvanizing process

There are two main processes used in the production of galvanized product namely :

Hot – dipped galvanizing and Electrolytic Galvanizing

**Hot – dipped Galvanizing** – It is one of the basic and efficient corrosion resistant technique for producing galvanized steel. During the galvanizing process, steel coils are previously cleaned and pickled and then dipped into a bath of molten zinc to form a series of zinc / iron alloys integrated with the steel surface. As steel is removed from the bath, a layer of relatively pure zinc is deposited on the top of alloy layers. On solidification, the zinc assumes a crystalline metallic luster, often known as “spangling”. The spangles can be enhanced and reduced depending on the end use.

The life of galvanized coating in steel structures permanently immersed in liquids depends on the corrosion properties of the liquid and the thickness of the galvanized coating in the structure.

Hot-dipped galvanizing technology has been greatly improved over the years and by the introduction of the Sendzimir process or one of its variants, HDG products are introducing on the market share of electrolytic galvanized products in the western world because it is more cost effective.

**Electrolytic Galvanized Steel** - In the electrolytic galvanizing process, zinc ions from the electrolyte are deposited on the strip surface (cathode) under the influence of electric current using either soluble or insoluble anodes.

Table – 5 : common applications of zinc coated galvanized steel

Coated product	Applications	Key Attributes
Galvanised	Air conditioning ducts, ventilation, Corrugated culverts, roof and floor, decking, pre-painted building, panels, storage bins, auto body inner panels, sheds etc.	Good formability and durability, range of coating thickness, strength and speed of installation, good paintability and cost-effective.
Electro-galvanised	Autobody outer panels, computer cases etc.	Good surface finish, weldability, electromagnetic shielding
Galanneal	Autobody outer parts, Pre-painted appliance wrappers	Weldability, paintability and formability
Galvalume	Bare and painted roofings and siding	corrosion performance for better coating paintability
Galfan	Pre painted architectural panels, automotive equipment	Corrosion performance, very good formability and paintability
Galbo	White goods, colour coating, storage bins, filing cabinets, bus body and auto components	Absence of spangles, improved aesthetics, no wastage during shittings.

Table – 4 : Broad sector wise consumption of galvanized steel in India

Sector	% share in Consumption
Construction	44
Consumer Durables	10
Drums, Barrels, Containers	9
Railways, Power, Irrigation	8
CPWD/PWD/Other Govt. Dept.	7
Tube makers	4
Furniture makers	6
Engineering units	6
Automobiles	4
Others	2
<b>Total</b>	<b>100</b>

The electrolyte is usually zinc sulphate or zinc chloride or mixed. The electro – galvanized strips are post treated with passivation solutions such as phosphate or chromate. The plating process controls the coating thickness resulting in much thinner coatings as well as double-side coatings.

The automobile industries in Japan and the U.S. are using between 35 to 45 percent of the total steel consumed in the form of electro-galvanized steel sheets. These sheets have excellent surface finish and press formability for protection from corrosion of auto body, fuel tanks, exhaust pipes etc. The Indian automakers are now using much higher quantities of electro-galvanized steel in their production.

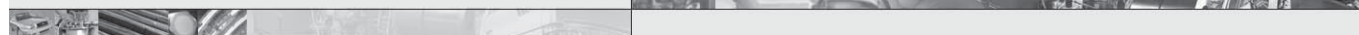
### Broad sector wise consumption of galvanized products

The broad sector wise consumption of CR sheets / Coils are shown in Table – 4.

### Common applications of zinc coated galvanized steel

Some common applications of zinc coated galvanized products are furnished in Table – 5.

### Estimated life of zinc



### coatings in various atmospheric conditions

The estimated life (in years) of zinc coated galvanized products in various atmospheric conditions are shown in table – 6.

Table – 6 Estimated life (years) of zinc coated products in various atmospheric conditions

Zn. Weight (gm/Sq.m)	Rural	Tropical Marine	Suburban	Urban	Highly Industrial
600	40	40	30	25	15
375	30	30	20	17	9
300	20	20	12	10	7
180	8	8	5	4	3
100	6	6	4	3	2

Source: Article by U K Mittal, formerly Director (Com) SAIL

### Major producers of GP/GC sheets with capacities

Producers	Annual capacity (000tonnes)
Rourkela Steel Plant	160
Bokaro Steel Plant	170
Tata Steel	400
Bhushan Steel & Strips Ltd.	350
Jindal I & S Co.	550
Ispat Industries	350
Uttam Galva	350
Sipta Coated Steels	100
Lloyds Steel Ltd.	125
Sree Precoated Steel Co.	350
National Steel	120
Jai corporation	100
Usha Rectifiers Ltd.	60
Essar Steel Ltd.	500

### Production of GP / GC sheets in India

Production of GP / GC Sheets in India between 1999-2000 and 2004-05 are shown in Table – 7.

The high yearly growth in production of GP/GC sheets

Table –7 Production of GP/GC sheets in India (\*000 tonne)

Year	Production			Y-O-Y Growth (%)
	ISPs	Secy. Producers	Total	
1999-2000	286	1144	1430	-
2000-01	423	1497	1920	34.27
2001-02	521	1835	2356	22.71
2002-03	666	2124	2790	18.42
2003-04	774	2356	3130	12.19
2004-05	804	2330	3134	0.13

Data Source : JPC

in India between 2000-01 and 2003-04 was due to a stiff growth in cumulative production by the ISPs 82-90 percent (average annual growth of 20.73 percent) as also due to a high cumulative growth in production by secondary producers during the period at 57.38 percent (average annual growth of 14.34 percent).

The marginal growth in production of GP/GC sheets in 2004-05 was due to the fact that production of secondary products declined by 1.1 percent and that of the ISPs went up by a low of 3.88 percent.

### Import and export of GP / GC sheets

Import and export figures of GP/GC sheets are to be bulleted in Table – 8.

Import of GP/GC sheets recorded a cumulative growth of 46.67 percent between 1999-2000 and 2004 – 05 and average annual growth of 9.33 percent. This has happened due to import of high quality products for high end applications as well as a result of dumping. A huge percentage of the imports was in defective quality.

Export of GP/GC sheets, recorded a cumulative growth of about 294 percent between 1999-2000 and 2004-05 with an average annual growth of 58.8 percent. The year 2002-03 saw the highest ever export of GP/GC sheets at 1.61 Mt, mostly to China, as against a domestic consumption of about 1.27 Mt. The exports fell to some extent due to higher domestic consumption in 2003-04 and 2004-05

### Apparent consumption of GP/GC sheets

The apparent consumption of GP/GC sheets in India between 1999-2000 and 2004-05 are presented in Table - 9.

The negative growth in consumption in 2002-03 was due to a much lower domestic demand of GP/GC sheets and a major thrust by the producers which resulted in the highest ever export at 1.61 Mt with a growth of over 131 percent as compared to previous year.

### Colour coated galvanised steel

Colour coated sheets are basically galvalume steel (also known as zincalume) which is an alloy consisting of 55 percent aluminum, 43.5 percent zinc and 1.5 percent silicon. These sheets are highly corrosion resistant and provide a tough barrier between the external atmospheric conditions and inner core of steel. Further, galvalume sheets protect steel at cut edges and scratches. This is achieved through the sacrificial protection provided by zinc in the coating. An additional advantage of using these sheets is its

Table – 8 Import and export of GP/GC sheets by India ('000tonne)

Year	Import	Export	Net Export	Export/ Production (%)
1999-2000	75	320	245	22.38
2000-01	73	589	516	30.68
2001-02	97	695	598	20.50
2002-03	92	1610	1518	57.71
2003-04	102	1486	1384	47.48
2004-05	110	1260	1150	40.20

Data Source: JPC

high reflectivity which promotes greater energy efficiency and cooler temperature operation in respect of shield components such as industrial furnace.

Colour coated steels find applications in toasters, dryers, washers, exhaust systems, refrigerators, air conditions, dehumidifiers, mufflers, ducts, ventilation, fencing system and highway signs. Galvalume sheets, however, cannot be used in frame works in contact with wet concrete, animal shelters where ammonia levels are high. Fertilizer storage,

Table – 9 Apparent consumption of GP/GC sheets in India ('000 tonnes)

Year	App. Consumption	Y-O-Y Growth (%)
1999-2000	1185	-
2000-01	1393	17.55
2001-02	1750	-25.63
2002-03	1265	-27.71
2003-04	1691	33.68
2004-05	2004	18.51

Data Source : JPC

culverts or where the steel is buried in the ground or in highly alkaline environments etc. Till recently there were only two manufacturers of colour coated sheets in India viz Ispat industries Ltd. and Shree Precoated Steels Ltd (SPSL) both having a capacity of 50000 tpy. Ispat is planning to double its capacity while SPSL has already expanded its capacity to 100,000 tpy.

Among the new entrants, Bhushan S&S Ltd has already commissioned a 1.2 lakh tpy capacity plant at Khopoli. Uttam Galva is constructing a 80,000 tpy capacity plant at Khopoli and JISCO is setting up an one lakh tpy plant at Tarapur and Steel Corporation of Gujarat (GSCL), a company promoted by Stelmor of UK is also setting up a colour coated steel plant. Essar Steel has made the acquisition of GSCL.

Tata Steel has planned to set up a colour coated line to produce spangle-free material for high end applications. India's colour coated steel demand is about 6 lakh tpy and

the country is importing about 55,000 tonnes of these materials annually.

### Galvanised Re-bars

Zinc coating provides an effective solution to combat corrosion of concrete reinforcement bars. In a tropical country like India where the moisture level is high for most part of the year and these bars have a relatively long traveling and waiting time before they are actually embedded in concrete. Galvanized coating is very use fuel to prevent early rusting of steel

Zinc coating offers protection against corrosion in rebars in two significant ways of action like :

\*Barrier action

\*Sacrificial action

### Conclusion

The market demands of CR coil / sheet and GP/GC sheets in 2011-12 have been put at 5.7 Mt and 2.6 Mt by the CPR study, as against an apparent consumption of 2.67 Mt and 2 Mt respectively in 2004-05. The CR and GP/GC industry at present is saddled with over capacity and their product market is showing a downtrend. In July 2005, market prices of CR products in the Mumbai market fell by Rs. 500 per tonne over prices in the previous month. Similarly, market prices of GP and GC sheets fell by Rs. 1000 per tonne for 0.63 mm size and by Rs. 2000 per tonne for 0.40 mm size.

Steel experts and market observers maintain that continual hike in HR coils prices since 2002 has hit the performance of the Indian cold rolling industry as the market for downstream products has not observed the arbitrary price hikes. Accordingly, the CR and its down stream industries have lost substantial market share to PVC, aluminium and asbestos etc. due to the high prices of HR coils and consequently that of CR products.

It is necessary for the Government to intervene, through fiscal and trade control measures to insulate the cold rolling and galvanized steel industry from the high volatility of global prices and curb distortions and monopolistic pricing of HR coils producers in the overall national interest.

