

Stainless Steel : Global and Indian Scenario

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Introduction

Stainless Steel is a value-added product that does not deteriorate during the lifetime of its use. Stainless Steel made its entry into the world of alloys less than a hundred year ago.

It is corrosion resistant and has high strength to weight ratio with excellent fatigue resistance properties.

Stainless steel finds its use right from injection needles to nuclear reactors, from rail cars to automobiles and pharmaceutical plants. The versatility of Stainless Steel is found in the wide range of its applications from creative expressions in architecture to the hygienic uses in household kitchenware.

Stainless Steel is a generic name that encompasses a family of twenty or more grades according to experts. Stainless Steels are essentially alloys of iron containing a minimum of 10.5 percent chromium and usually 50 percent of iron. Its classification depends on the content and quality of chromium along with other materials like nickel, molybdenum etc. that has been used while producing it.

The Key attributes of Stainless Steel may be summarized as follows:

- Excellent corrosion resistance does not require coatings.
- Strength increases with cold work.
- Excellent elongation and formability properties.
- Availability in wide range of surface finishes.
- Can be readily clad on carbon steel.
- Excellent fatigue resistance.
- Easy to clean - hygienic.
- 100 percent recyclable.
- Very good energy absorbing properties.
- High tensile strength.
- Low thermal conductivity.
- Easily formed and welded with conventional equipment.
- Good resistance to high temperature.
- High strength to weight ratio.

Global Scenario

Historically, the first use of stainless steel was made in 1913 in making cutlery items. Since then it found application

as an engineering product for food processing industry. Later, it penetrated into textile industry where many precision components were made of stainless steel.

In the building sector, stainless steel was introduced in 1930 for cladding the top portion of the Chrysler Building in New York, USA. The stainless steel cladded top portion remains in very good shape even to-day, after 76 years of its first use.

Global Production of Stainless Steel

Global production of stainless steel in 1913, in the year when it was invented, was only a few tones. In 1963, after 50 years, the world production reached 2.5 Mt. the global production of stainless steel crossed the 10 Mt mark in 1986.

The global production of stainless steel between 1995 to 2005 is presented in table-1

Table-1: Global Production of Stainless Steel: 1995 to 2005(>000 tonnes)

Year	Production	Y-O-Y Growth (%)
1995	16,248	-
1996	16,162	(-) 0.53
1997	17,395	7.63
1998	17,185	(-) 1.21
1999	17,872	4.00
2000	19,300	7.99
2001	19,185	(-) 0.60
2002	20,679	7.79
2003	22,840	10.45
2004	24,570	7.57
2005	24,330	(-) 0.98

Data Source: IISI, ISSF.

It may be observed from the above table that high growth in global stainless steel production occurred in the years 1997, 2000, 2002, 2003 and 2004. The highest negative

growth of 1.21 percent was recorded in 1998. The average yearly growth in the last ten years has been about 5 percent.

Recent Scenario of Global Production.

The International Stainless Steel Forum (ISSF) has announced that the world production of crude stainless steel declined by about 1 percent to 24.32 Mt in 2005.

The strong decrease in stainless steel production in the third and fourth quarters of the year 2005, has resulted in the first decline since 2001 when the global production recorded a negative growth of 0.6 percent.

According to ISSF, the cut in production in the second half of 2005 was the result of a dramatic reduction in demand.

Asia was the largest stainless steel producing areas in the world, in 2003, 2004 and 2005 with shares in global production at 46.6 percent, 48.4 percent and 51.4 percent respectively.

Regionwise Production of Global Stainless Steel - Recent Trends.

Asia was the largest stainless steel producing region in 2005. The production was driven by China, whose output rose to 3.2 Mt in 2005, recording a growth of 34 percent over 2004. India's production also rose by 11 percent to 1.5 Mt in 2005 over the previous year. All other stainless steel producing countries in Asia failed to match their 2004 outputs in 2005. Asia's total stainless steel production grew by 5 percent to about 12.5 Mt in 2005.

The second largest stainless steel producing region is Western Europe/Africa. The output in this region recorded a negative growth of 6.4 percent in 2005 over 2004 as the production in this region declined to 8.8 Mt from 9.4 Mt. Only Spain and Italy recorded growths. Production in Central and

Eastern European region at 310,000 tonnes in 2005 went down by 2.5 percent over 2004.

Production of stainless steel in the American region recorded a high decline of 8.3 percent in 2005 over 2004.

ISSF expects a growth of 10 percent in Asia in 2006 as new capacities are coming up. In Asia only China and India showed continued growths in 2005. However, ISSF expects that stainless steel production in all Asian Countries will grow in 2006.

Demand Trend

Demand for stainless steel in the Central and Eastern European region showed strong increase in 2005. However, local production facilities were not capable to meet this demand.

Since the middle of 2005, the global stainless steel market has been hit by an extreme lack of demand. The decrease continued into the early part of 2006. Market demand has started to grow in April, 2006 in Europe and China. However, the demand in total Asia and the Americas were still slow upto April, 2006.

Global Prices of Stainless Steel

Stainless steel prices in the global market has shot up sharply between January, 2006 and early May, 2006 due to the surging input prices coupled with strong demand, especially in China. For example, prices of stainless steel grade 304 which were hovering at US \$ 2,100 per tonne in January, 2006 have reached US \$ 3,000 per tonne level in the global market in early May, 2006.

The global stainless steel industry has been grappling with nickel prices on the L.M.E. surging from US \$ 13,500 per tonne in January, 2006 to US \$ 18,545 at the end April 2006. Stainless Steel scrap prices reached US \$ 300 per tonne a gain of 10-15 percent since the beginning of 2006.

Table-2: Stainless and Heat-Resisting Crude Steel Production and ISSF Forecast For 2006-By Region ('000 Tonnes)

Region	Production			% Growth		Forecast for 2006	
	2003	2004	2005	2004/2003	2005/2004	Production	% Growth
W. Europe/Africa	9043	9422	8823	4.2	(-) 6.4	9480	7.4
Central / E. Europe	322	318	310	(-) 1.2	(-) 2.5	320	3.2
The Americas	2830	2933	2689	3.6	(-) 8.3	2850	6.0
Asia	10645	11897	12498	11.8	5.0	13750	10.0
World Total	22840	24570	24320	7.6	(-) 1.0	26400	8.6

Data Source: ISSF.

The Indian Scenario

Production of stainless steel began in India at the Alloy Steel Plant (ASP) at Durgapur, West Bengal in the late 1960's. Its production gradually increased to 24,000 tonnes in the mid 1970's.

During the eighties of the last century, the government changed its policies allowing the production of all types of steel in the secondary sector. New capacities were created and the country's production reached about 170,000 tonnes in the 1984-85.

At this juncture, the Cold Rolling Mill of Salem Steel Plant was commissioned and India's production of stainless steel reached 527,000 tonnes in 1994-95. Thus, in ten years between 1984-85 and 1994-95, India's production of stainless steel recorded an average yearly growth of 21 percent.

In 2000-01, the production reached 75,000 tonnes. It reached 1.25 Mt in 2003-04 recording an average yearly growth of 22.2 percent in the three years between 2000-01 and 2003-04. India at present is one of the 15 major leading producers of stainless steel in the world.

Earlier, the eighties of the last century also saw installation AOD/VOD processes by some major Electric Arc Furnace (EAF) units resulting in the use of high carbon ferrochrome for the first time in India which brought down the cost of production. Small business units started using the Induction Furnace (IF) route for melting stainless steel scrap for recycling into usable stainless steel.

Towards the late eighties of the last century two major developments took place:

The Indian Stainless Steel Development Association (ISSDA) was founded by seven leading stainless steel producers in the country with the object of diversifying and boosting the use of stainless steel.

Nickel prices shot up to high levels in 1988. To counter this, the Indian technologists developed low nickel high manganese austenitic stainless steel in the 200 series. In the last decade or so, there has been a standardization of these grades for individual application areas to get higher yield and low cost downstream processing.

With the dawn of 21st Century, India has emerged as a net exporter of stainless steel products as well as fabricated and value-added components and kitchenware. The

stainless steel producers and the ISSDA are optimistic about the future of stainless steel in India both in terms of growth in domestic application as well as a hub for downstream value chain.

India is producing all popular grades of stainless steel based on end-use viz 200, 300 and 400 series as per AISI specifications. However, due to the high cost of nickel and its non-availability in India, the 200 series containing nickel between 1 to 4 percent was developed in the 1990's. India has now emerged as the largest producer of 200 series in the world. A large part of Indian stainless steel exports belong to the 200 series.

Presently, the Indian stainless steel industry is capable of meeting all the critical requirements for the nuclear power industry and other process industries by supplying higher grades of stainless steel containing nickel and molybdenum. The 400 series is extensively used for coinage and by the automobile industry.

The capacity for stainless steel production in India is in far excess of domestic demand and the country exports about 40 percent of the production. India produced about 1.25 Mt of stainless steel in 2003-04 and 1.7 Mt in 2004-05. India exports stainless steel to China, Middle East, and South East Asia, Vietnam etc.

India has a huge unorganized sector which accounts for about 6 lakh tones of production per year in the form of low nickel stainless steel popularly known as 'DATTA'. Alongside, the country has organized sector having producers like Jindal Stainless, Salem Steel Plant, Alloy Steel Plant, Mukand Ltd and some other new generation producers. The organized sector caters primarily to the upper end of quality requirement in the Indian stainless steel market.

The per capita consumption of stainless steel in India is about 1 kg as compared to 12 kg in South Korea and 2.5 kg in Malaysia. Globally, it is about 4 kg.

The end-use of stainless steel in India is still dominated by kitchenware. New applications in the area of building and construction as well as transport sector are showing positive signs of growth in the last decade. New applications of stainless steel for building and construction along with up gradation of fabrication skills has resulted in the extensive use of stainless steels in airports, railway coaches and platforms, hotels, malls, petrol pumps and corporate house buildings.

The change in pattern of stainless steel consumption in India is evident from Table-3 below:

Table-3: Sector wise Consumption of Stainless Steel in India and the Western World.

Sector	Western World	India	
	2004	1998	2004-05
Construction	11.6	0.5	2.0
Transportation	14.9	0.5	2.0
Process Industries	19.4	11.0	10.0
Catering Equipment	36.5	75.0	70.0
Welded & Seamless Tubes	11.8	4.0	10.0
Others	5.8	9.0	6.0
Total	100.0	100.0	100.0

Data Source: ISSF and article by Dr. S.K. Dutta and A.B. Lele for Indian Statistics (JPC Bulletin, March'06)

It is observed from the above table that the percentage share of stainless steel in the catering equipment segment has come down from 75 percent to 70 percent in the above period with significant increases in construction and transportation sectors.

Major Producers of Stainless Steel in India (I) Jindal Stainless Ltd :

JSL an ISO : 9002 and ISO : 14001 certified company, is the flagship company of the Jindal Organisation. The company started with hot rolling of plain carbon and high carbon steel in 1970. Looking ahead at the untapped potential for stainless steel in the country, the company started production of stainless steel in 1979 by selling up the first AOD converter in the country at Hisar. Since then, the company has gone a long way in expansion of the plant and achieved a turnover of over Rs.3218 crore in 2005-06.

Jindal Stainless is the largest integrated producer of stainless steel in India catering to about 45 percent of the stainless steel requirement of the country and exports more than 40 percent of its production to China, Middle East Europe and the U.S. etc. The export growth is driven by the in-house development of low nickel 'J' series. The popularity of these 'J' series grade is growing fast and has the ability to replace higher grades like AISI 304 for variety of applications in utensils, household appliances, furniture, decorative trims, railings etc.

Jindal Stainless has a strong presence in certain overseas markets for its thin cold rolled strips and coils for a variety of scientific and industrial usage. JSL achieved a

high export turnover of Rs. 1220.78 crore in 2005-06.

JSL has a ferro-chrome plant at kothavasala in Andhra Pradesh with an installed capacity of 40,000 tpy of high carbon ferro-chrome. Besides supplying to the domestic market, the company also exports ferro-chrome to various developed countries.

JSL is among the four major producers of razor blade steel in the world and the only producer of this grade in India. The company caters to about 90 percent of India's razor blade stainless steel demand. JSL's coin blanking line supplies coin blanks to Indian Mints and Mints in global market.

JSL is endeavouring to innovate and improve quality with cost reduction. The company's present capacity is 600,000 tpy. JSL has signed a MoU with the Orissa Government for setting up an integrated stainless steel plant of 1.6 Mtpy capacity at Kalinganagar in the Jaipur district of Orissa. The present investment will be of Rs. 950 crore and will include a 250,000 tpy ferro alloys plant along with a 500 MW capacity captive power plant. JSL has acquired 1240 acres of land for the stainless steel plant and another 3000 acres for the proposed power project's ash pond. The state-of-the-art facilities will have submerged arc furnace for manganese along with blast furnace, steelmelting shop, slab casting facilities, gas based cogeneration. According to JSL sources, this will be the largest stainless steel plant in South Asia.

JSL has also entered into a technology tie-up with Nissin Steel of Japan, a global leader and a top quality stainless steel producer in the world. This will lead to transfer and upgradation in operation technology for improving production, quality and yield at the Hisar plant.

(II) Salem Steel Plant (SSP)

SAIL's SSP is certified for ISO:9001:2000 Quality Assurance and ISO:14001:1996 Environmental Management System. SSP is one of India's leading producers of quality stainless steels. The plants is capable of rolling 186, 200 tonnes of hot-rolled carbon/stainless flat products and 70,000 tonnes of cold-rolled stainless sheets/coils annually. SSP's products, branded 'Salem Stainless', are well accepted in the domestic and international markets.

SSP's Blanking Line has an annual capacity to produce 4,000 tonnes of ferritic-grade coin blanks or 3,600 tonnes of utility blanks. One rupee, 50 paise and 25 paise coins are minted from blanks supplied by SSP to Government Mints. The plant also supplies ferritic stainless strips to Govt. Mints.

SSP has gone beyond its designed capacity in producing thinner gauges and supplies value-added 0.13 mm thick stainless steel and hot rolled special grade carbon steels. SSP's boiler quality steels are also well known. The plant also supplies LPG grade IS: 6240 steel in sheet form. The plant has also developed new applications of its products viz LPG tanks for automobiles, stainless steel ceiling fans, exhaust fans, corrugated sheets, water tanks etc.

Industrial segments using 'Salem Stainless' include hi-tech areas like atomic power stations heavy engineering, chemical and fertilizers, railways, automobiles, construction, dairy and food processing, bulk solid handling, power etc.

'Salem Stainless' was used long ago for the retractable roof of the Melbourne Tennis Stadium in Australia. 'Salem Stainless' weighing about 400 tonnes was used in the world's tallest TWIN TOWERS, the PETRONAS Towers at Kuala Lumpur in Malaysia. 'Salem Stainless' has also been used in Canada and the U.S.

In India, about 350 tonnes of 'Salem Stainless' steel was used in the Parliament Library in Delhi. The 40ft by 70ft signage at the Ramoji Film City at Hyderabad used 60 tonnes of AISI 304 grade Salem Stainless Steel. About 70 tonnes of 'Salem Stainless' in the corrugated form was used for the 10,000 square meter dome-shaped roof of the Kopar Khairane railway station at Navi Mumbai. Similar projects are underway at the Turbhe and Airoli railway stations. 'Salem Stainless' has also been used in the 'Tree' at the Priyadarshini Park in Mumbai and 'Garuda' at the T.C.I. headquarter at Gurgaon.

According to the Executive Director, SSP, the plant has set a total production target between 240,000 to 250,000 tonnes in 2005-06.

(III) Alloy Steel Plant (ASP)

SAIL's Alloy Steel Plant is the pioneer in the area of alloy and stainless steel production. The entire plant is certified to ISO: 9001:2000 standards. ASP has the capacity to produce Slabs, Blooms, Bars, Plates and forged items in over 400 grades in a wide range of sizes totaling 178,000 tonnes of saleable steel annually. Among the value-added items produced by the plant are CRM rolls, concast rollers, crane wheels, springs, hammers, grate bars, hot saw blades, shear blades, stainless steel liner plates etc. ASP also supplies import substitution items to many customers through established conversion agents.

Enforcing strict quality control measures at each stage of processing, various product development projects at

ASP has led to the successful commercial production thus achieving a high standard of excellence in production of special stainless steels.

Major developments made by ASP in the area of various grades are:

Austenitic Stainless Steels

- AISI 304 L with enhanced corrosion resistance.
- AISI 304 L with extra low magnetic permeability.
- AISI 304 L used in Indira Gandhi Centre for Atomic Research at Kalapakkam.
- AISI 310 through continuous casting.
- One per cent Nickel bearing austenitic steel.

Ferritic Stainless Steels

- Ferritic AISI 430 through modified chemistry for coinage, appliance manufacture and architectural works.
- AISI 409 (modified) or AISI 409 M for coal wagons catering wet abrasion and corrosion resistance.

Martensitic Stainless Steels

- AISI 420 (modified) or 420 M for continuous casting machine foot rollers.
- DIN x 20 Cr. MoV 121 developed for creep resistant bolts for BHEL. Also successfully applied for hanger rods of the roofs of VAD/VOD secondary refining units.

(IV) Mukand Ltd.

The company was the first in India to install a Walking Beam Furnace. Its plant has a cooling bed and a fully automatic Wire Rod Mill with continuous casting. Mukand is an ISO: 9002 company and produces about 50,000 tpy of stainless steel products to various grades in AISI 300 and 400 series.

Mukand is investing Rs.120crore for expansion up to 2007. It plans to increase the alloy steel capacity from 330,000 tonnes to 460,000 tonnes by 2006 and its stainless steel capacity at Kalwe from 55,000 tpy to 100,000 tpy by 2007. Mukand's turnover in 2005-06 was Rs 1592 crore.

New Generation Producers and Others

a) Shah Alloys Ltd. : An ISO: 9002 certified company, Shah Alloys is a leading producer of stainless steel in India. It produces both long and flat stainless steel products. Production is carried out through I.F. route with AOD converter. The company has installed an 1800mm wide caster and a H.R. Coil Mill with a width of 2000mm for rolling 1800mm coils.

b) Viraj Group : It produces all types of stainless steel in austenitic, ferritic, martensitic and duplex variety, Viraj plant has a modern meltshop, C.C. machine and a rolling mill. The plant is equipped with two AOD converters, ladle refining



furnace with calcium cored wire injection system. The plant is ISO: 9002 certified and its annual turnover is about US \$ 120 million. Viraj is a 100 percent export Oriented unit.

c) ISI Bars Ltd. : The company is a fully integrated producer of stainless steel having continuous casting and secondary refining facilities. Its annual production, including conversion of ball bearing etc. is about 60,000 tonnes.

d) Mahindra UGINE Steel Co. (MUSCO) Ltd. : It is one of the early producers of stainless steel in India and not a new generation plant. It has secondary refining and continuous casting facilities. It produces about 10,000 tpy of high quality stainless steel.

e) Panchmahal Steel Ltd. : It has two continuous casting machines, AOD furnace and a ladle refining furnace. It is annually producing about 30,000 tpy of high quality stainless steel.

f) Ambica Steels Ltd. : Its plant is ISO: 9001:2000 and ISO: 14001:1996 certified and its manufacturing facilities include a 20 tonnes Induction Furnace, 20 and 30 tonne AOD converters, a 9/16 metre Twin Strand fully closed bloom caster capable of casting 120mm square to 220 * 250mm blooms and billets. The semi-automatic rolling mill of the plant can roll flat and round bar products.

Some other companies like FACOR, Kalyani Steels, Suraj Stainless Ltd. are also producing quality stainless steel.

New Applications of Stainless Steel in ABC and ART Sectors

As, mentioned earlier, the pattern of stainless steel consumption has changed between 1998 and 2004-05. The percentage share of consumption of Catering Equipment has gone down from 75 to 70 percent while the share of Construction and Transportation has gone up from 0.5 to 2.0 percent in both cases.

Some of the new application in architecture, building and construction (ABC) and automobile, railways and transportation (ART) sectors are mentioned below:

i) ABC Sector :

Since the late eighties of the last century, stainless steel has been used in the southern cities like Chennai, Bangalore and Hyderabad in construction of staircase, hand rails, pillar cladding etc. this trend is fast picking up in the recent past in Mumbai, Delhi and Kolkata.

Some application in the ABC sector has been mentioned earlier under Salem Steel Plant. Other new applications of stainless steel are found in the cladding of 19 meter high OBELISK(Stambh) at Gomti Nagar near Lucknow, ING Vaisya Bank in Bangalore, value pillars at the Balaji Corporate headquarters at Pune, R&D centre of JSL at Hisar, Reliance Classic at Hyderabad, Rolling Shutters at Nashik

and Dhatar in Maharashtra, new bus stands at Delhi etc. Many shopping malls, big hotels, banks, corporate office buildings and modern high-rise building are using stainless steel.

Stainless Steel when used in buildings for internal plumbing lines helps prevention of dust collection, rust or other foreign bodies and ensures flow of hygienic clean water. The first ever stainless steel pipeline was used in Mettur in Tamil Nadu and is being now followed in other places in India. Use of stainless sinks and wash basins is also fast picking up.

Use of stainless steel domestic LPG cylinders is increasing. The 50 percent weight reduction, corrosion resistance, minimal maintenance cost are added advantages and are particularly suitable for hilly and remote areas.

The Bureau of Indian Standards (BIS) has assigned IS:15637:2006 for domestic LPG cylinders for stainless steel type 304L, 1/16 hard and IS:14899:2000 for LPG cylinders in automobiles has been covered separately.

ii) ART Sector :

a) Automobiles : Stainless steel catalytic converters is a preferred material for auto exhaust system due to environmental reason. Each of such units use 6 to 12 kgs of stainless steel depending on the model and make. India produced over 13 million passenger vehicles in 2005-06 which promises a good consumption of stainless steel. Indian motor cycle manufacturers are using stainless steel in the critical locations as fasteners etc. the use of stainless steel LPG cylinders in cars are also gaining momentum.

b) Railways : At present stainless steel weighing 11 tonnes are being used in long distance super fast trains. Currently RCF at Kapurthala and ICF, Perambur are together rolling about 2000 such coaches annually. Each of Delhi Metro coaches use 12 tonnes of stainless steel. The Mumbai Rail Vikas Corporation (MVRC) has also planned to use similar coaches for the Navi Mumbai routes. A modified version of AISI 409 developed by ASP, Durgapur for coal wagons are being used by the India Railways in about 1200 such coal wagons.

Conclusion

Stainless steel is a very small but significant member of the steel family. The notion of high initial cost is gradually giving way to the life cycle cost analysis approach. The number of flyovers and new generation cars are flooding the market. While ISSDA and the industry are doing their best to widen the scope of diversified applications of stainless steel, favorable government policies will help the industry in a big way. The Indian stainless steel industry is growing at a fast space and its future is quite bright.

