



# Focus on Indian Stainless Steel Industry

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## Introduction :

Stainless steel is a class of alloy that constitutes of 10-30 percent of Chromium as the major ingredient responsible for corrosion resistance. It has a high strength to weight ratio and excellent fatigue resistance properties. It has also aesthetic appeal, excellent lustre, low wear, increased strengths and high durability.

Through varying Chromium content and addition of varying Ni, Mo, Mn, Ti and Nb etc. Stainless steels are broadly grouped as Austenitic, Ferritic, Martensitic, Duplex and Precipitation Hardening grades which offer varied micro – structures, physical, mechanical and chemical properties for specific application requirement of end – use.

## Key Attributes & Stainless Steel

The key attributes of stainless steel may be summarised as follows :

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

**Classification of Stainless Steels :**

**Stainless steels Arc usually grouped into five categories :**

- i. Austenitic stainless steels**
- ii. Ferritic stainless steels**
- iii. Martenistic stainless steels**
- iv. Duplex stainless steels**
- v. Precipitation Hardening stainless steels. It is based on the type of heat treatment rather than micro – structure.**

**i) Austenitic Stainless Steels :**

These steels have austenitic structure from room temperature to temperature below melting range and hence cannot be hardened by heat treatment. The Austenitic stainless steels Arc hardened by cold work and show increased work hardening rate compared to the other class of stainless steels facilitate by transformation to deformed induced marten sites. These steels contain 16 percent (minimum) of chromium and 3 percent Nickel (Nickel substituted by other austenitic phase stabilizing like Nitrogen, Manganese and copper) and ranges through high alloy or 'Super Austenitics' such as 904L and 6 percent Mo grades. Modifications are made to the base alloy through other elements and are classified based on specific properties imported for application requirement.

The addition of Nickel in austenitic grades increases density, coefficient of thermal expansion and corrosion resistance. They possess superior impact strength and toughness compared to the Ferritic stainless steel grades. Manganese – Nickel Austenitic grades offer higher strength than nickel bearing grades over a wide temperature range with yield strength nearly 40 percent higher and offer greater resistance to stress corrosion cracking, carbide precipitation and pitting.

**ii) Ferritic Stainless Steels :**

These steels Arc basically chromium based and Arc generally ferritic at all temperatures although some of the grades exhibit austenitic structure at high temperatures and can transform to martensite. In annealed condition, they show fully ferritic structure at room temperature. The Ferritic stainless steels Arc not strengthened by heat treatment.

The ductility and formability for ferritic stainless steels in some cases Arc quite good. Drawing properties Arc excellent due to low hardening rate. However, toughness is relatively low. Temperature is around the room temperature. These steels possess low levels of strength. The corrosion resistance and oxidation properties Arc influenced by the amount of chromium present in the steel which varies from 11 to 27 percent for different grades.

**iii) Martensitic Stainless Steel :**

These steels generally have 11 to 18 percent chromium and have austenitic structure at elevated temperatures that can be transferred to martensitic (i.e. hardened) by suitable cooling to

room temperature. Hardened martensitic steels cannot be successfully cold formed. They Arc magnetic, have moderate corrosion resistance and poor weldability.

**Duplex Stainless Steels :**

The steels have chemical composition and balanced (duplex) microstructure of approximately equivalent volume fraction of ferrite and austenite. Their properties Arc summed up as follows :

- a)** The chemical composition based on high chromium and Mo improves inter – granular and pitting corrosion respectively.
- b)** Additions of nitrogen can promote structural hardening by interstitial solid solution mechanism which raises yield strength and ultimate strength values impairing toughness.
- c)** The two – phase micro – structure guarantees high resistance to pitting and stress corrosion cracking.
- d)** The toughness of duplex stainless steel grades is superior to that of ferritic grades but inferior to austenitic grades.
- e)** These steels Arc readily welded and also have high tensile strength.

**Precipitation Hardening Stainless Steels :**

These steels contain 15-18 percent Chromium and Nickel and develop high tensile strength with heat treatment. These grades Arc usually supplied in a solution treated condition that allows the steel to be machined. After machining or forming, the steel can be aged in a low temperature heat treatment process. As the heat treatment is performed at low temperatures, no distortion is induced in the work piece.

**Global Stainless and Heat – Resisting Crude Steel Production**

The global stainless steel and heat resisting Crude Steel production during 2006 – 2007 and estimates for 2008 Arc shown in Table – 1

**Table-1 : Stainless and Heat – Resisting Crude Steel Production ('000 tons)**

Region	2006	2007	+/- %	2008 (e)	+/- %
Western Europe / Africa	10,000	8,669	(-) 13.3	9050	4.4
Central & Eastern Europe	376	364	(-) 3.3	370	1.7
The Americans	2951	2604	(-) 11.8	2700	3.7
Asia	15,074	16,030	6.3	17,200	7.3
Total (World)	28,400	27,666	(-) 2.6	29,320	6.0

**Data Source : ISSP N.B. – Totals may not tally due to rounding off.**

According to ISSF forecast, global production may reach 29.32 Mt in 2008. But in view of the current global financial crisis, the growth in 2008 will be much lower than 6 percent projected by the ISSF, as the crisis is expected to continue upto the second quarter of 2009.

Actual global production declined by 2.6 percent in 2007 to 27.6 Mt. This includes a stock draw of more than 1 Mt. During 2007, the basic global demand for stainless steel, according to ISSF, increased by more than 8 percent in the light of strong, worldwide

industrial growth rates.

Asia continues to be the largest stainless steel producing area in the world. In 2007, Asia was the only region with increased production. China was the driving force behind the production.

Growth in Asia followed by India, China was the highest producer of stainless steel in the world in 2006 outstripping Japan. China was also the highest producer in 2007.

### The Indian Scenario :



India's production of stainless steel began in the late sixties of the last century at SAIL's Alloy Steel Plant at Durgapur, West Bengal.

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 for the production of stainless steel came up and the country's production reached about 170,000 tons in 1984-85. SAIL's Salem Steel Plant (SSP) was commissioned on 13th September, 1981 and the inauguration of the 2nd Phase of SSP expansion took place on 9th April, 1988.

The eighties of the last century also saw the installation of AOD/VOD processes by some major Electric Arc Furnace (EAF) units resulting in the use of high carbon ferro-chrome for the first time in India which brought down the cost of production. Some smaller units started production through the Induction Furnace (IF) route by melting stainless steel scrap and recycling it into usable stainless steel.

**Towards the late eighties of the last century two major developments took place. These were :**

- The Indian Stainless Steel Development Association (ISSDA) was founded by the 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 grades in the 200 series. In the last decade on so, there has been some standardisation of these grades for individual application areas to get higher

yield and low cost down stream processing.

With the dawn of the 21st Century, India has emerged as a net exporter of stainless steel products as well as fabricated and value – added components and Kitchenware. In 2007-08, according to the provisional figures published by the Joint Plants committee, India imported about 443,000 tons of alloy and stainless steel products and exported 450,000 tons of these products.

India is producing all popular grades of stainless steel based on end-use viz. 200, 300 and 400 series as per AISI specifications. Presently, the Indian stainless steel industry is capable of meeting all the critical requirements of the nuclear power installations 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.

Due to the high cost of nickel and its non-availability in India, the 200 series containing low nickel was developed in the 1990's. India has now emerged as the largest producer of the 200 series in the world. A large portion of India's stainless steel exports belongs to the 200 series. Three grades of 200 series Arc being standardised to BIS specifications.

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

### Change in Mind Set :

About a decade ago – stainless steel was considered good only for kitchenware by the common man and experts / technologists of various industries. But now, ever increasing number of architects, designers, railway engineers, auto industry professionals, city planners, civic agencies, airport, railway station and transport authentic and even designers of malls, multiplexes, retail space etc. have realised that stainless steel, with its elegance, durability and minimal requirement of maintenance is ideal for their use and now they prefer this material over the traditional ones.

Against a share in consumption of 75 percent in 2004-05 and 70 percent in 2006-07, kitchenware would go down to a level of 52 percent (estimated) as follows :

### End Use Pattern of Stainless Steel use in India

End-use Sector	2004-05 (%)	2015 – 16 (%)
Metal Products (mainly Kitchenware)	75	52
Process Industry	10	12
Construction	2	12
Transportation	2	6
Engineering	5	7
Electro – Mechanical / Electronics	2	3
Others	4	8
<b>Total</b>	<b>100</b>	<b>100</b>

Source : R.R. Gopal, E.D., ISSDA – JPC Bulletin June, 2007

India's stainless steel consumption is likely to group from

Year	Production ('000 Tons)
2003 – 04	1,250
2004 – 05	1,708
2006 – 07	2,515
2007 – 08	2,705

Data Source : JPC

2,463,000 tons as against 2,517,000 tons in 2006-07 recording a marginal decline of 2.15 percent.

### Production of Stainless Steel in India :

Production of stainless steel in India for some selected years Arc mentioned below :

It is observed that between 2003-04 and 2007-08, India's average annual growth in production of stainless steel has been 54 percent due to a low base in 2003 – 04.

### Application of Stainless Steel in ABC and ART Sectors :

#### (A) ABC Sectors :

During the last decade many new applications of stainless steel has taken place in India, in the ABC sector. Some of these Arc mentioned below. ABC sector denotes Architectures, Buildings and Construction.

- About 350 tons of stainless steel was used in the Parliament library.
- The 40 ft. by 70 ft. signage at the Ramoji Film City at Hyderabad used 60 tons of AISI 304 grade stainless steel.
- About 70 tons of stainless steel was used for the 10,000 square meter dome – shaped roof of Kopar Khairane Railway Station at Navi Mumbai.
- Stainless steel has also been used in the 'Tree' at the Priyadarshini Park in Mumbai and 'Garuda' at the TCI Head Quarters at Gurgaon.
- A total 60 tons of stainless steel has been used in the roofing system of Khalsa Heritage Complex at Anandpur Sahib over an area of 3756 square meters, the large ever stainless steel roofing executed in India.
- An obelisk (stambh) about 19 meter high, has been clad at the B. R. Ambedkar International Library and Museum of social changes at Gomti Nagar at Lucknow.
- Operational Head Quarter of DMRC has used stainless steel cladding innovation stainless, steel tubular truss with S.S. panels. Total quantity of stainless steel sheet and tubes used was 30 tons.
- About 200 stainless steel bus shelters have been installed in the NMDC area of New Delhi. Delhi Transport Corporation (DTC) is also installing another 225 bus shelters on the Ring Road at New Delhi. Each bus shelter uses about 850 kg of stainless steel.
- About 100 columns and walls of Ahmedabad airport have been clad with using AISI 304 sheets. About 7 tons of stainless steel was used.

Other import stainless steel uses have taken place in the R&D

1,154,000 tons in 2004-05 to a level of estimated 4,084,000 tons in 2015-16 if the current financial crisis do not affect the consumption adversely.

In, 2007-08, Indian consumption alloy and of stainless steel was

Centre of Jindal Stainless Ltd. at Hissar, ING Vaysa Bank in Bangalore, Reliance Classis at Hyderabad, Rolling Shutter at Nashik and Dhatar in Maharashtra. About 2,300 bus shelters Arc under installation in Mumbai made of stainless steel. Many shopping malls, big hotels, banks, corporate offices and other high rise buildings Arc using stainless steels in escalators, railings, sinks / wash basins in hotels and all types of buildings. It is estimated that the use of stainless steel in the ABC sector has increased five times during the last 6/7 years. Use of stainless steel in the LPG sector is also going up at a high rate.

#### (B) Art Sector :

New applications of stainless steel Arc going at a fast rate in the Automobile, Railways and Transportation (ART) sector.

#### Automobile Sector :

i. Stainless steel catalytic converters Arc preferred material for auto exhaust system for environmental reasons. Each such unit use to 6 to 12 kgs of stainless steel depending on the model and make. India produced 1.76 million passenger vehicles in 2007-08. If 60 percent of this production of stainless steel catalytic converters, a big quantity of stainless steel will be consumed.

ii. Indian motor cycle manufacturers Arc using stainless steel in critical locations such as fasteners, engines and now handles made of stainless steel Arc also being used.

iii. The use of stainless steel LPG cylinders in cars is also gaining momentum.

#### Railway Sector :



i) The railway workshop of Southern Railway at Trichy has received an order for manufacturer of 1200 stainless steel 409M grade wagons. Each wagon will use 8.7 tons of stainless steel.

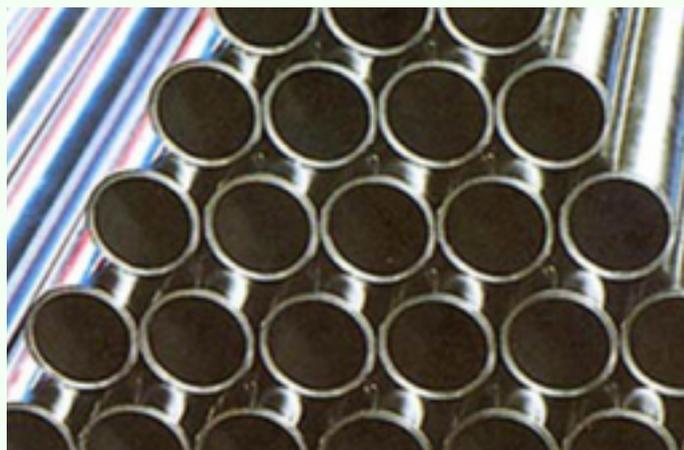
ii) Indian Railways have a fleet of 30,000 passenger coaches of corten steel (carbon) which demand – excessive amounts of maintenance cost. They also do not last long. LHB coaches with stainless steel shells Arc currently produced in RCF, Kapurthala. Being a stainless steel of 12 percent chromium, their corrosion resistance needs to be reinforced with paint system. In further all corten carbon steel coaches will be replaced by stainless steel

coaches.

**iii)** To increase the supply of stainless steel coaches by 2009-10 onwards only stainless steel coaches will be manufactured by RCF, Kapurthala and ICF, Chennai (Perambur).

**iv)** The Indian Railways Arc planning two new rail coach factories- one at Rai Bareilly in U.P. and the other in the Palghat district of Kerala for manufacturing all stainless steel coaches. The Rai Bareilly factory will start production in 2010 with an initial production of 1,200 coaches. From the second year onwards, it will produce 2,400 coaches per year. The Palghat facility will be ready by 2012 and is expected to produce 600 coaches annually which will be expanded to 1,000 coaches for annum in due course.

**v)** The RDSO of the Indian Railways has taken the initiative to the Design of Higher Axle Load (25 T) wagons. These wagons will have stainless steel body and underframe. Further, 25 ton Axle Load Bottom Discharge Coal Wagons (Type BOBRN – 25) with



stainless steel body and underframe will be manufactured. Railways have tendered for 37,000 tons of 409M stainless plates and sheets having minimum alloying elements. It contains ; C-0.03 max, Cr-10.8 to 12.5, Ni-1.50 max, Ti – 0.75 max. Each of these wagons will have on weight of 8.7 tons.

**vi)** Railways have decided to use only stainless steel coal wagons. For the production of these wagons about 80,000 tons of 409M grade stainless steel has been tendered by the Indian Railways to make 7,000-8,000 coal wagons in 2007-08. Each such wagon will use about 10 tons of 409M grade of stainless steel.

**vii)** Mumbai Rail Vikas Corporation (MRVC) will buy 1,500 coaches from ICF, Chennai. About 2.5 tons of stainless steel will be used for each coach. Stainless steel is being used for roof panels, fans, partitions, doorway grab poles etc. by MRVC.

#### **Transportation :**

**i)** More and more volumes of stainless Arc being used in luxury buses.

**ii)** Airports Arc being decorated and used for aesthetic

appearance. Stainless steel is being used in walls, aerobridges, lounges, artificial ceilings, escalators and in various offices.

**iii)** Port Authorities Arc also using more volumes of stainless steel in their various equipments, offices and other installations.

#### **Profiles of Some Leading Producers of Stainless Steel in India :**

##### **Jindal Stainless Steel (JSL) :**

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 steels in 1970. Looking ahead at the untapped potential of stainless steel in the country, the company started production of stainless steel in 1979 by setting up the first AOD converter in the country at Hissar in Haryana.

Jindal stainless is the largest integrated producer of stainless steel in India catering to about 45 percent of the country's requirement and exports about 40 percent of its production to China, Middle East, Europe and the USA etc. JSL's export growth is driven by the in-house development of low nickel 'J' series grade. The populating of these grades has grown fast in the last five years or so. It has the capability to replace higher grades like AISI-304 for variety of application in utensils, house hold appliances, furniture, decorative trims, railways etc. JSL has also a strong presence in certain overseas markets for its thin cold-rolled stainless steel strip and coils for a variety of scientific and industrial usage.

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

JSL is making constant endeavour to produce improved products in an environment friendly manner through its R&D. Its plant at Hissar has a capacity of 600,000 tpy. JSL is also in the process of increasing its annual melting and hot rolling capacity in Hissar to 900,000 tons by 2010.

Jindal stainless will invest about Rs. 960 crore in its new Orissa project at Kalinganagar. This project involves mining of iron ore, chrome and manganese, ferro – alloy complex besides steel melting and rolling mills. A 500 MW capacity captive power plant is also being constructed.

The company has already invested Rs. 2,250 crore for setting up the greenfield integrated stainless steel plant in Orissa state of 1.6 Mtpy capacity. The plant is being commissioned in three phases. The first phase has already been completed. The second phase will entail an investment of Rs. 5,600 crore and the third phase will see an investment of Rs. 3,000 to 4,000 crore.

## Salem Steel Plant (SSP) :

SAIL's SSP is certified for ISO : 9001 : 2000 Quality Assurance and ISO : 14001 : 2004 Environment Management Systems. It is one of India's leading producers of Quality stainless steels. The plant based at Salem in Tamilnadu, is capable of rolling 186,200 tpy or hot rolled carbon / stainless steel flat products and 70,000 tpy of cold-rolled stainless steel sheets / coils. Its blanking line has the capacity to produce 3,000 tpy of ferritic grade coin blanks or 3,600 tpy of utility blanks. SSP's products domestic and international markets.

The plant produces cold-rolled and hot-rolled stainless steel products beyond its designed capacity in thinner and thicker gauges. It is also capable of producing and supplying micro-alloyed carbon steel. New applications of stainless steel Arc being continuously developed and special grades Arc being supplied for manufacturing metro rail coaches.

SSP is also engaged in conversion and supply of its products like kitchenware, tubes, pipes and far other applications. It is also undertaking turnkey projects. Apart from value – added products, new finishes are being developed and supplied for various architectural applications, railways and elevator segments etc.

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

### SSP has taken up the following projects :

Product	Annual Capacity	
	2005	After Expansion
Crude Steel	-	0.18 Mt
Saleable Steel	0.17 Mt	2.85 Mt

- Installation of steel melting and continuous casting facilities to produce 180,000 tpy of slabs along with a single strand caster.
- Expansion of the CRM complex to enhance the cold – rolled stainless steel production capacity from 65,000 tpy to 146,000 tpy.
- Additional roll grinding machine for the H.R. Mill to expand its production capacity to 370,000 tpy.
- Upgradation of the existing Sendzmir Mill for quality and productivity improvements.

According to SAIL sources, about Rs. 1,553 crore investment will be made at SSP for expansion-cum-backward integration plan.

## Alloy Steel Plant (ASP) :

ASP, located at Durgapur, is the pioneer in the area of alloy and special steels production in India that was specially designed for casting. Austenitic and Ferritic stainless steel and a variety of non-stainless steels including bullet – proof steel. The plant has one slab-cum-twin bloom continuous casting (CC) machine, the only

one of its kind in India. The entire plant is certified to ISO:9001–2000 Quality Assurance Standard.

ASP has the capacity to produce slabs, blooms, bars, plates and forged items of over 400 grades in a wide range of sizes totaling 178,000 tpy of saleable steel. Among the value – added items produced by the plant Arc CRM rolls, concast rollers, crane wheels, springs, hammers, grate bars, hot saw blade, bright bars, stainless steel liner plate etc.

ASP also supplies import substitution items to many customers through reputed and established conversion agents.

The plant has added state of threat facilities like a new Electric Arc Furnace (EAF), Argon Oxygen Decarbonisation (AOD) unit and Gynogenic Air Separation Plant for manufacturer enhanced



volume of stainless steel slabs.

Enforcement of 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 the production of special stainless steels.

Further facilities to augment the capacity of the plant and enhancement of the quality has also been planned.

## Mukand Ltd. :

Mukand was the first in India to install a Walking Beam Furnace. Its plant at Kalwe in Maharashtra has a cooling bed and a fully automatic Wire Rod Mill with continuous casting facility.

Mukand is a ISO:9002 certified company and produces about 50,000 tpy of stainless steel products to various grade in AISI 300 and 400 series.

Mukand had planned to invest Rs. 120 crore to enhance its alloy steel capacity from 330,000 tpy to 460,000 tpy and its stainless steel capacity from 55,000 tpy to 100,000 tpy by 2007-08.

In addition to the above, Mukand has preferred a Rs. 300 crore capital expenditure plan to expand its brownfield facilities in Karnataka and Maharashtra and setting up a greenfield project at Lonand near Satara in Maharashtra.

**Viraj Group :**

In 1992, Viraj started manufacturing stainless steel at Tarapur in Maharashtra. At the onset, only one steel melt shop was operational followed by a rolling mill for long products.

The company's growth continued with the installation of the Forge shop, Merchant Mill for the production of angles, flats, other merchant sections as well as Fastner Plant in 2006. In the same year, the group went for major expansion by installing a new Steel Melt Shop and a Bar Mill supplied by VAI Pomini of Italy.

With the commissioning of the new melt shop, the melting capacity went up to 350,000 tpy of stainless steel. A Wire Rod Mill capable of rolling wire rods with diameter ranging from 5.5 to 34 mm was also installed in 2005-06.

In 2004, Viraj acquired Bebitz, the largest producer of flanges in Europe based in Germany. Later in 2004, the group acquired



Tubinox, a tube manufacturer of Romania for making seamless tubes and pipes.

Viraj has an annual turnover of US\$ 1 billion with an installed melting capacity of 348,000 tpy. It is the second largest producer of stainless steel flanges in the world. Viraj exports its products to 90 countries worldwide.

The group is setting a new port based Ferro Alloy Plant near Mumbai. The plant would produce ferronickel / nickel big iron with a capacity of 25,000 tpy of nickel and 90,000 tpy of ferro chrome.

**Valley Iron and Steel Co. (VISCO) :**

VISCO is an over Rs. 3000 million multi-diverse, multi-product enterprise. The company's plant is equipped with state-of-the-art ultra high EAF, Induction Furnace, AOD, LRF, concast machine and a most modern Hot Rolling Mill.

Presently VISCO manufacturers a wide range of products like billets and flats in various series like AISI 200, 300 and 400, a combination of products capable of producing catering equipment, pipes and allied products for industrial, automobile and construction sectors.

From a turnover of Rs. 713.9 million and a profit of Rs. 8.49 million in 2004, VISCO achieved a turnover of Rs. 3,020 million in 2007. It has set an ambitious target of achieving a sale of Rs. 10 billion and a profit of Rs. 500 million by the end of 2009.

**Ambica Steels Ltd.:**

Ambica Steels is located at Sahibabad, Near Delhi and produces ingots, billets, round bars and flat bards encompassing various types of forged and rolled products, which finds wide ranging applications in forging industries as well as stainless steel fabrication industries. It has an installed capacity of 40,000 tpy.

Ambica has the capabilities for manufacturing an assortment to AISI grades 316Ti, 316, 316L, 317, 321, 304L, 316, 410, 420 etc.

The Quality Assurance Department of Ambica Steels ensures that its products Arc customised in accordance to the requirement of its clients.

The company has ISO:9000 system its ISO:9001-2000 version. It has also obtained certification for ISO:14001-1996 for its excellent environment management system.

**Suraj Stainless Ltd. :**

Suraj is a leading manufacturer and exporter of stainless steel seamless and welded pipes, tubes and 'U' tubes in various specifications and grades. The company is exporting its products to over 60 countries all over the world.

Suraj has a well equipped manufacturing unit at Thol Village near Ahmedabad in Gujarat. The company is specialised in tubing for various equipment, such as heat exchangers, heaters, condensers, heating elements etc.

The company's comprehensive product range covers – from outer diameter of 6 mm to 219.08 mm with suitable wall thickness from 6.0 mm to 10.0 mm in standard length upto 30 meters.

Suraj's present manufacturing programme includes production of tubes and pipes of austenitic stainless steel and duplex stainless steel grades. Suraj is an ISO : 9001 and AD – Merkblatt W.O. and Pressure Equipment Directive (PED) company in addition to the Government of India recognizing the company as one of the Export Houses. It won the award, named 'Exports Excellence Certificate' in recognition of its achieving highest – exports for several years.

**Conclusion :**

The Indian stainless steel industry has shown remarkable growth in terms of production and consumption in recent years. The ISSDA and Nickel Institute in collaboration with the leading stainless steel producers, have done commendable work to increase the consumption of stainless steel by diversifying their consumption pattern and replaced carbon steel in many areas of usage.

The Indian Railways have taken a judicious decision to use stainless steel in a big way. This will help them to save a huge amount of expenditure in the long run.

The global financial crisis has also affected India's economic and industrial growth adversely. But this phase will change for the better after a year or so.

The Indian stainless steel industry is destined to perform better in future years and would hold its head high among the producers of these products worldwide.