Indian Minerals Yearbook 2018

(Part- III : MINERAL REVIEWS)

57th Edition

CHROMITE

(FINAL RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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November, 2019

6 Chromite

Chromite is the single commercially viable ore of chromium (Cr) which is chemically known as iron chromium oxide (Fe Cr_2O_4). The properties of chromium that make it most versatile and indispensable are its resistance to corrosion, oxidation, wear & galling and enhancement of hardenability. Chromium is an important alloying metal in ferrous metallurgy, perhaps next only to manganese. It is used in the manufacture of alloys along with other metals, such as, nickel, cobalt, molybdenum, copper, titanium, zirconium, vanadium, columbium and selenium. Chromium is traded primarily as chromium ore or as an alloy of chromium and iron, namely, ferrochrome or charge-chrome. The name of the element is derived from the Greek word '*chrôma'*, meaning colour, because many of its compounds are intensely coloured. It is a steely-grey, lustrous, hard and brittle metal which takes high polish, resists tarnishing and has a high melting point.

RESERVES/RESOURCES

As per NMI database based on UNFC system, the total reserves/resources of chromite in the country as on 1.4.2015 has been estimated at 344 million tonnes with 102 million tonnes as "Reserves" (30%) and 241 million tonnes as "Remaining Resources" (70%). More than 96% resources of chromite are located in Odisha, mostly in Jajpur, Kendujhar and Dhenkanal districts. Minor deposits are scattered over Manipur, Nagaland, Karnataka, Jharkhand, Maharashtra, Tamil Nadu, Telangana and Andhra Pradesh. Gradewise, Charge chrome grade accounts for 31% resources followed by Beneficiable grade (25%), Ferrochrome grade (18%) and Refractory grade (14%). Low, Others, Unclassified and Not-known grades together account for 12% (Table- 1).

EXPLORATION & DEVELOPMENT

The exploration and development details, if any, are covered in the Review on Exploration & Development in "General Reviews".

PRODUCTION AND STOCKS

The production of chromite was 3,481 thousand tonnes during 2017-18 which decreased by 7% as compared to that in the previous year.

The number of reporting mines was 25 in 2017-18 as compared to 26 in the preceding year. The share of Public Sector in total production was 28% in 2017-18 as compared to 34% in the previous year. About 26% of the total production was reported from captive mines in the current year as compared to 27% in the previous year.

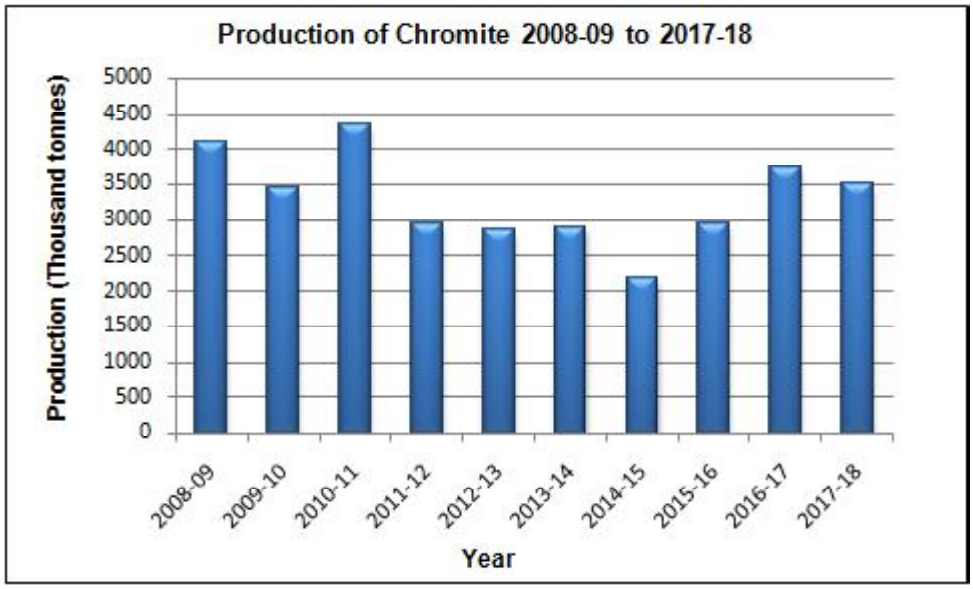

Table – 1 : Reserves/Resources of Chromite as on 1.4.2015
(By Grades/States)

(In '000 tonnes)

Grade/State	Reserves				Remaining Resources								Total Resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total	**64465**	**12815**	**24930**	**102210**	**67618**	**15780**	**33506**	**26914**	**33076**	**44458**	**20452**	**241806**	**344016**
By Grades													
Refractory	26759	2803	416	29978	9234	987	320	3635	550	2958	-	17684	47662
Charge chrome	16476	-	9328	25804	25726	8333	4048	8931	25000	7861	7	79905	105709
Low	-	-	-	-	26	27	-	-	-	3713	-	3765	3765
Beneficiable	12528	10012	9018	31557	17992	2272	10649	6856	6069	10301	-	54139	85697
Ferrochrome	7809	-	6033	13842	14043	2004	17888	7483	1134	4942	10	47504	61346
Others	133	-	-	133	348	377	-	-	15	-	-	740	873
Unclassified	761	-	135	896	250	1780	602	9	308	14506	19889	37343	38239
Not-known	-	-	-	-	-	1	1	-	-	177	546	725	725
By States													
Andhra Pradesh	-	-	-	-	-	-	-	-	-	-	-	-	-
Jharkhand	-	-	-	-	-	-	-	15	98	623	-	736	736
Karnataka	315	340	72	727	300	230	96	-	20	259	-	905	1631
Maharashtra	-	48	23	71	5	-	5	43	67	418	-	538	609
Manipur	-	-	-	-	3	21	52	-	504	6077	-	6657	6657
Nagaland	-	-	-	-	-	-	-	-	-	3200	-	3200	3200
Odisha	64150	12427	24835	101412	67311	15529	33354	26850	32372	33434	20452	229301	330714
Tamil Nadu	-	-	-	-	-	-	-	7	-	276	-	282	282
Telangana	-	-	-	-	-	-	-	-	15	171	-	186	186

Figures rounded off

Odisha continued to be the major chromite producing State that accounted for almost the entire production during 2017-18. However, production was also reported from Karnataka and Maharashtra.

Gradewise analysis of production during 2017-18 reveals that of the total production of chromite 38% was accounted for by 40-52% Cr_2O_3 (Lumps 4% and Fines 34%), followed by 52% & above Cr_2O_3 fines grade which accounted for 30% of the total production.

Mine-head closing stocks of chromite in 2017-18 were at 2,270 thousand tonnes as compared to 2,694 thousand tonnes in 2016-17.

The average daily employment of labour in chromite mines during 2017-18 was 7,095 as against 6,959 in the previous year (Tables- 2 to 8).

Table – 2 : Principal Producers of Chromite 2017-18

Name & address of producer	Location of mine	
	State	District
Tata Steel Ltd, Bombay House, 24, Homi Mody Street, Fort, Mumbai – 400 001, Maharashtra.	Odisha	Jajpur
The Orissa Mining Corporation Ltd, 'OMC House', Unit 5, Post Box No. 34, Bhubaneswar – 751 001, Odisha.	Odisha	Jajpur
Indian Metals & Ferro Alloys Ltd, IMFA Building, Bomikhal, Rasulgarh, Bhubaneswar – 751 010, Odisha.	Odisha	Jajpur, Kendujhar
Balasore Alloys Ltd, Balgopalpur, P.O. Rasalpur, Balasore - 756 020, Odisha.	Odisha	Jajpur
Ferro Alloys Corporation Ltd, Laxmi Bhawan, Kuans, Bhadrak – 756 100, Odisha.	Odisha	Jajpur

Table – 3 : Production of Chromite, 2015-16 to 2017-18
(By States)

(Qty in tonnes; Value in `'000)

State	2015-16		2016-17		2017-18 (P)	
	Qty	Value	Qty	Value	Qty	Value
India	**2915584**	**21214490**	**3727780**	**31937475**	**3480928**	**32109182**
Karnataka	1808	10884	785	3768	-	-
Maharashtra	90	432	1	5	17	82
Odisha	2913686	21203174	3726994	31933702	3480911	32109100

Table – 4 : Gradewise Production of Chromite, 2016-17 (By Sectors, States and Districts)

(Qty in tonnes; Value in `'000)

State/ District	No. of mines	Production by Grades : Cr_2O_3 Content						Concentrates	Total	
		Below 40%		40-52%		52% & Above				
		Lumps	Fines	Lumps	Fines	Lumps	Fines		Quantity	Value
India	**26**	**126837**	**530913**	**142026**	**1354052**	**-**	**1101936**	**472016**	**3727780**	**31937475**
Public sector	10	2554	154181	200	696933	-	371048	46980	1271896	14657031
Private sector	16	124283	376732	141826	657119	-	730888	425036	2455884	17280444
Karnataka	**3**	**785**	**-**	**-**	**-**	**-**	**-**	**-**	**785**	**3768**
Hassan	3	785	-	-	-	-	-	-	785	3768
Maharashtra	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**5**
Bhandara	1	-	-	-	-	-	-	-	1	5
Odisha	**22**	**126051**	**530913**	**142026**	**1354052**	**-**	**1101936**	**472016**	**3726994**	**31933702**
Dhenkanal	3*	-	-	-	-	-	-	-	-	-
Jajpur	15	125351	530913	141826	1354052	-	1101936	472016	3726094	31929382
Kendujhar	4	700	-	200	-	-	-	-	900	4320

** Only labour reported*

Table – 5 : Gradewise Production of Chromite, 2017-18 (P) (By Sectors, States and Districts)

(Qty in tonnes; Value in `'000)

State/ District	No. of mines	Production by Grades : Cr_2O_3 Content						Concentrates	Total	
		Below 40%		40-52%		52% & Above				
		Lumps	Fines	Lumps	Fines	Lumps	Fines		Quantity	Value
India	**25**	**86430**	**601120**	**145029**	**1185915**	**-**	**1046446**	**415988**	**3480928**	**321091**
Public sector	10	4780	160064	2657	434383	-	359636	12895	974415	102242
Private sector	15	81650	441056	142372	751532	-	686810	403093	2506513	218849
Karnataka	**3***	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Hassan	3*	-	-	-	-	-	-	-	-	-
Maharashtra	**1**	**10**	**-**	**7**	**-**	**-**	**-**	**-**	**17**	**-**
Bhandara	1	10	-	7	-	-	-	-	17	-
Odisha	**21**	**86420**	**601120**	**145022**	**1185915**	**-**	**1046446**	**415988**	**3480911**	**321091**
Dhenkanal	3	-	1128	1202	-	-	-	-	2331	126
Jajpur	15	81640	599799	141163	1185915	-	1046446	415988	3470950	320477
Kendujhar	3	4780	**193**	2657	-	-	-	-	7630	486

** Only labour reported*

Table – 6 : Production of Chromite, 2016-17 and 2017-18 (By Frequency Groups)

(Qty in tonnes)

Production group	No. of mines		Production for the group		Percentage in total production		Cumulative percentage	
	2016-17	2017-18 (P)	2016-17	2017-18 (P)	2016-17	2017-18 (P)	2016-17	2017-18 (P)
Total	**26**	**25**	**3727780**	**3480928**	**100.00**	**100.00**	-	-
Up to 10000	14	13	1686	9978	0.04	0.29	0.04	0.29
10001- 100000	3	3	213508	174173	5.73	5.00	5.77	5.29
100001 - 200000	5	4	750006	533499	20.12	15.33	25.89	20.62
200001 - 300000	-	2	-	476316	-	13.68	-	34.3
300001 and above	4	3	2762580	2286962	74.11	65.70	100.00	100.00

Table – 7 : Mine-head Closing Stocks of Chromite, 2016-17 (By States/Grades)

(In tonnes)

State	Stocks by Grades: Cr_2O_3 Content						Concentrates	Total Quantity
	Below 40%		40-52%		52% and above			
	Lumps	Fines	Lumps	Fines	Lumps	Fines		
India	**45399**	**1563635**	**15823**	**535097**	**617**	**406447**	**127424**	**2694442**
Karnataka	20694	303	-	-	-	-	-	20997
Maharashtra	190	-	-	-	-	-	-	190
Odisha	24515	1563332	15823	535097	617	406447	127424	2673255

Table – 8 : Mine-head Closing Stocks of Chromite, 2017-18 (P) (By States/Grades)

(In tonnes)

State	Stocks by Grades: Cr_2O_3 Content						Concentrates	Total Quantity
	Below 40%		40-52 %		52% and above			
	Lumps	Fines	Lumps	Fines	Lumps	Fines		
India	**56391**	**1498356**	**12455**	**336917**	**285**	**249231**	**116085**	**2269721**
Karnataka	20691	303	-	-	-	-	-	20994
Maharashtra	10	-	7	-	-	-	-	17
Odisha	35690	1498053	12448	336917	285	249231	116085	2248710

MINING & TRANSPORT

At present, mining operations for chromite are restricted in the Sukinda ultramafic belt, in the Baula Nausahi chromite belt in Odisha, in Hassan district of Karnataka and minor quantity is also produced in Maharashtra. The method of exploitation of chromite in the areas includes both opencast and underground mining. Chromite outcrops generally are under overburden cover of 3 to 9 m. The overburden is generally soft, consists of aluminous laterite, murrum and laterite except in areas near the base of the Mahagiri Hill. The ore extracted from Kathpal mine and from all the mines in the Baula Nausahi belt is hard and massive. In all other mines, the ore occurs as friable and powdery.

The excavation of overburden in opencast mines is done by digging with shovels.The overburden generated is then loaded and transported by trucks & dumpers of 10 & 35 tonnes capacity, respectively. In the case of hard overburden of hard murrum or laterite or serpentinised quartzite etc. drilling and blasting procedures are commonly utilised. Drilling, done with jack hammer, and blasting (with appropriate quantity of explosives) loosen the hard formations which enable removal of overburden. The ores are subsequently excavated, sorted and stacked. In manual mines, ore is extracted manually by using pick axe.

South Kaliapani is the main chrome ore mine of Odisha Mining Corp. Ltd. In South Kaliapani mine nominal blasting is done to loosen the ore which is then transported to stack yard and sorted manually. The ores for dissemination are transported and stacked separately.

Underground mining is practised in four chromite mines viz. , Kathpal mine of M/s FACOR, Nausahi mine of M/s IMFA, Bangur chrome ore mine of Odisha Mining Corp. Ltd and Baula mine of M/s FACOR. The Kathpal chromite mine of M/s FACOR and Mahagiri mine of M/s IMFA are both underground and opencast. Maheswari lode is mined by underground method of mining whereas Balaji lode is mined by opencast method.

ENVIRONMENTAL PROBLEMS

The major problems associated with chromite mining are the pollution and degradation caused to the environment. The hexavalent chromium, especially in friable ore is the major cause of concern as it is carcinogenic in nature. The hexavalent chromium contamination of water bodies is a major issue that requires concerted attention. Viable treatment methods of pumping water, especially with ferrous sulphate solution, before it being discharged must be rigorously implemented as remedial measure. Ferrous sulphate solution converts the hexavalent into trivalent form which is non-carcinogenic. Incidentally, Mining Research Cell, Indian Bureau of Mines, during 2008-09 undertook a study for attenuation of hexavalent chromium in Sukinda chromite belt by bio-remediation technology which is apparently environment-friendly. This study was a S & T Project undertaken in association with the Utkal University. Air pollution by dumping is another major factor that leads to environmental degradation particularly during dry season.

Chromium contamination of air also comes from emissions of coal-based power plants and industrial chimneys of iron & steel and ferrochrome industries, from spray paintings, chrome baths, refractory industries and mining of chromite & magnesite. In rural areas, chromium in atmosphere rarely exceeds 1mg/cu m of air, but in towns with major Iron & Steel Industries the levels may be 1000 times more.

The inhalation of chromium compounds has been associated with the development of cancer in workers in the Chromite Industry. The relative risk for developing lung cancer has been calculated to be as much as 30 times. There is also evidence for an increased risk of developing nasal, pharyngeal, and gastrointestinal carcinomas. Quantitative epidemiological data were obtained by Mancuso and Hueper (1951), who observed increased occurrence of deaths (18.2%; $p<0.01$) from respiratory cancer among chromite workers as compared with 1.2% deaths where controls were at place. In a follow-up study conducted when more than 50% of the cohort died, the observed incidence for lung cancer deaths had increased to approximately 60%.

CONSUMPTION

The consumption of chromite increased by about 7% from 22,89,500 tonnes in 2016-17 to 24,48,700 tonnes in 2017-18. Almost the entire consumption (97%) was by Ferro alloys/Charge chrome Industry. In addition to above, chromite in substantial quantities is also consumed by small-scale ferrochrome units, information for which is scarce. Besides, nominal consumption is reported by Refractory Industry and a negligible amount by others. Data on consumption of chromite and ferrochrome from 2015-16 to 2017-18 are furnished in Tables- 9 & 10.

Table – 9 : Estimated Consumption* of Chromite 2015-16 to 2017-18 (By Industries)

(In tonnes)

Industry	2015-16	2016-17(R)	2017-18 (P)
All Industries	**2447800**	**2289500**	**2448700**
Chemical	9700	5400	5000
Concentrates (Chrome ore/ chromite)	43000	66500	60700
Ferro-alloys (including chargechrome)	2374300	2212700	2378500
Refractory (including iron & steel)	20100	4100	3600
Others (foundry, ceramic, calcination & glass)	700	800	900

Figures rounded off

** Includes actual reported consumption and/or estimates made wherever required. Paucity of data, hence coverage may not be completed.*

Whereas, the apparent consumption of chromite for the year was 36,51,472 tonnes.

Table – 10 : Estimated* Consumption of Ferro chrome, 2015-16 to 2017-18 (By Industries)

(In tonnes)

Industry	2015-16	2016-17 (R)	2017-18 (P)
All Industries	**290200**	**15900**	**14600**
Alloy Steel	30400	13600	13600
Iron & Steel	259200	2200	900
Others (Electrode Foundry)	600	100	100

Figures rounded off

** Includes actual reported consumption and/or estimates made wherever required. Coverage may not be complete due to paucity of data.*

USES

In metallurgy, chromite is mainly used in the manufacture of ferrochrome, silicochrome, charge chrome and chromium metal. Chromium imparts additional strength, hardness and toughness to its alloys. It also shows resistance to corrosion & prevents steel abrasion, reduces oxidation and flow of electricity. Stainless steel, high-speed tool steel and corrosion & heat-resistant steel are some of the important varieties of chromium steel.

Ferrochrome is of two types: (i) high carbon (containing 4-8% carbon) and (ii) low carbon (containing up to 2% carbon). The amount of chromium used in steel varies with the purpose. Low chromium steels (less than 5% chromium and small amount of nickel) are used in rails, automobiles, armour plates, armour piercing projectiles, etc. Intermediate chromium steels (3-12% Cr and small amounts of W, Mo or Si) are used in high-speed tools, valves for engines and other equipment requiring resistance to abrasion, corrosion and oxidation. Chromium steels include stainless steel (12-18% Cr) and super-stainless steel (12-30% Cr and 7-10% Ni) which are used for cutlery and cooking utensils, in aircraft & high-speed trains, respectively. Chromium (17%) along with iron (83%) is also used as ferritic stainless steel to manufacture coins.

Chromite is used in Refractory Industry because of its high chemical stability, its high temperature resistance and corrosion resistant properties. Further, its high melting point, ability to withstand sudden temperature changes, its chemically neutral character, moderate thermal expansion and mechanical strength besides abundant availability and reasonable price are added advantages for use in Refractory Industry.

Chromite is used for manufacturing important chromium compounds like chromates and bichromates of sodium and potassium, chromium pigments like chromic oxide green and chromic acid, which in turn, are used in chromium-plating solution.

Chromium is an essential trace element for human health. However, some of its compounds are highly toxic and carcinogenic. Environment concerns have reduced the use of chromite refractories and chromium chemicals.

SUBSTITUTES

Development of substitutes for chromium tends to be deterred by cost performance or the customer appeal for chromium. There are no substitutes for chromium in stainless steel or superalloys. Boron, manganese, nickel and molybdenum can be substituted in alloy steels and cast irons. Base metal alloys can sometimes be used in place of stainless steel. Dolomite is an alternative for some refractory bricks. Cadmium yellow is one of the several alternative pigments. However, it is not environmentally acceptable and nickel and zinc are possible substitutes for the protection of decorative coatings.

SPECIFICATIONS

The specifications of chromite vary for different end-use industries. The Cr.Fe ratio is one of the important factors to be considered before deciding the end-use of the mineral. The BIS has specified IS:10818-1984 specifications of chromite for Metallurgical Industries. IS: 10819-1999 (First Revision Oct. 2011) for specifications of chromite for Refractory Industry, IS: 4737-1982 (First Revision, Reaffirmed 2011) for specification of chromite for Chemical Industry and IS : 6788: 1973 (Re-affirmed Feb.2014) for specification of chromite sand for Foundry Industry.

INDUSTRY

Chromite is mainly used in Metallurgical Industry for manufacture of ferro-alloys, e.g., ferrochrome, charge chrome and silicochrome which are used as additives in making stainless steel and special alloy steel. Ferro-alloys are the essential ingredients for the production of high quality special alloy steel as well as mild steel. The demand for ferro-alloys is associated with the production of alloy steel.

Production of ferrochrome/charge chrome was mainly reported by Ferro Alloys Corp. Ltd, Shri Vasavi Industries Ltd, Balasore Industries Ltd, Tata Steel Ltd, Indian Metals & ferro-Alloys Ltd and Indian Charge-chrome Ltd (merged with Indian Metals & Ferro alloys Ltd in 2006) were amongst the major producers of charge chrome in India. Charge chrome contains 50 to 60% chromium and 6 to 8% carbon. Hard lumpy chromite is used for high carbon ferrochrome while friable ores and fine briquettes are used for low carbon ferrochrome. Briquette fines along with lumpy ores were also consumed in charge chrome plants.

India is ranked fourth in global ferrochrome production. The production has been at 1.0 to 1.1 million tonnes over the past 4-5 years.India consumes 15-30% of its production and exports the rest to countries like China, South Korea and Japan. The domestic consumption of ferrochrome has not grown for two main reasons- a) except for the top three ferrochrome players - IMFA, Tata Steel and Balasore Alloys - others are in financial difficulties; b) Domestic Stainless Steel production which is largely accounted for by the Jindal Stainless Group of late is under severe duress. The Indian Ferrochrome Industry is likely to get consolidated as capacities owned by Rohit Ferro Alloys and FACOR Alloys are to be auctioned through the National Company Law Tribunal (NCLT) shortly. Recently, NCLT released the results of bidding for FACOR's assets.

The important plants which produce chromite based refractories are Tata Steel Ltd (formerly OMC Alloys), Orissa Industries Ltd, Bhilai Refractories Ltd, Burn Standard Co. Ltd, Joglekar Refractories and Ceramics (P) Ltd and Associated Ceramics Ltd.

Ferrochrome when added to steel imparts hardness, strength and augments its stainless characteristics. Carbon content classifies the ferrochrome alloy into high carbon (6-8%), medium carbon (3-4%) and low carbon (1.5-3%), although chromium content in all the three grades is around 60-70 percent. Around 2.5 tonnes chrome ore with an estimated power consumption of 4,500 kWh is required to produce one tonne of ferrochrome.

Ferro Alloys Corpn. Ltd, Garividi, Andhra Pradesh; GMR Technologies & Ind. Ltd, Srikakulam, Andhra Pradesh; Jindal Steel & Power Ltd, Raigarh, Chhattisgarh; Standard Chrome Ltd, Raigarh, Chhattisgarh; SAL Steel, Kachchh-Bhuj, Gujarat; Balasore Alloys Ltd, Balasore, Odisha; IDCOL Ferro Chrome Plant, Jajpur Road, Odisha;

Indian Metals & Ferro Alloys Ltd, Theruballi, Odisha; Jindal Stainless Ltd, Duburi, Odisha; Nava Bharat Ferro Alloys Ltd, Dhenkanal, Odisha; Rawat Ferro Alloys, Cuttack, Odisha; Rohit Ferro Tech. P. Ltd, Bishnupur, West Bengal; and Sri Vasavi Ind. Ltd, Bishnupur, West Bengal are the major ferrochrome producers in the country. A sizeable quantity of ferrochrome is also produced by units in the Small-scale Sector.

In February 2017, Greenfield Ferro-chrome plant of 55,000 TPA capacity at Gopalpur of M/s Tata Steel Ltd commenced production. Chromite mine at Sukinda became the first unit to obtain Integrated Management System (IMS) certification (ISO 9001:2015, ISO 14001:2015 and OHSAS 18001:2007). Tata Steel Ltd, FACOR and Indian Metals & Ferro Alloys Ltd (IMFA), the three major producers of chargechrome in the country are 100% export-oriented, having a total capacity of 1,82,500 tpy. Tata Steel with its chargechrome plant at Bamnipal, Odisha has a capacity of 55,000 tpy, while FACOR has a capacity of 65,000 tpy chargechrome at its Randia Plant, Bhadrak district, Odisha. Indian Metals & Ferro Alloys Ltd, (IMFA), Cuttack district, Odisha has an installed capacity of 62,500 tpy.

Vishnu Chemicals Ltd has plants at Medak, Visakhapatnam (Andhra Pradesh) and Bhilai (Chhattisgarh) which produces chromium products, such as, sodium dichromate (70,000 tpy), basic chromium sulphate, chromic acid (1,000 t) and Potassium Dichromate (1,000 t). There were two producers of chromium chemicals in small quantities in the organised sector, namely, Tamil Nadu Chromates and Chemicals Ltd and Krebs & Cie (India) Pvt. Ltd, Kolkata.

Commercially, chrome ore can be divided into three categories: (i) high-grade, containing >48% chromite, (ii) medium-grade with > 40% chromite and (iii) low-grade containing less than 40% chromite. Chromite with less than 40% is not exported under present trade policy.

Chromium metal and the alloy ferrochromium are commercially produced from chromite by silicothermic or aluminothermic reactions, or by roasting and leaching processes. Chromium metal assumes high value due to its properties, such as, high corrosion resistance and imparting of hardness.

The discovery that steel could be made highly resistant to corrosion and discolouration by adding metallic chromium to form stainless steel led to major developments in the Steel Sector. This application, along with chrome plating (electroplating with chromium) are currently the major commercial use for the element. The element also finds application in the production of chromium compounds, albeit to a minor extent.

The strengthening effect of forming stable metal carbides at the grain boundaries and the strong increase in corrosion resistance has made chromium an important alloying material for steel. The high-speed tool steels contain between 3 and 5% chromium. Stainless steel, the main corrosion-proof metal alloy is formed when chromium is added to iron in sufficient concentrations usually above 11%. User's specifications of chromite in Major Consuming Industries are furnished in Table-11.

Table – 11 : User's Specifications of Chromite in Major Consuming Industries

Industry/Name and location of plant	Specifications of ore consumed
FERROCHROME/CHARGE CHROME	
Andhra Pradesh/Telangana	
Andhra Ferro Alloys Ltd, Kothavalasa, Distt Vizianagaram	N.A.
Cronimet Alloys India Ltd, Ravivalasa, Distt Srikakulam	Lumps : Cr_2O_3 40% to 50% Fines : Cr_2O_3 40% to 52% Concentrates : Cr_2O_3 40%

(Contd.)

Table-11 (Contd.)

Industry/Name and location of plant	Specifications of ore consumed
Ferro-Alloys Corp. Ltd, Shreeram Nagar, Distt Vizianagaram	Lumps : Cr_2O_3 38% to 40% Fines : Cr_2O_3 38% to 40% Friable : Cr_2O_3 48% to 50% Concentrates : Cr_2O_3 48% to 50%
JSL Ltd, (formerly Jindal Stainless Steel Ltd,) Jindal Nagar, Distt Vizianagaram	Lumps : Cr_2O_3 38% Cr:Fe : 2 : 9
Metkore Alloys & Industries Ltd, Ravivalasa, Distt Srikakulam	N.A.
Nav Bharat Ventures Ltd, Paloncha, Distt Khammam	Lumps: Cr_2O_3 28-42% Fines: Cr_2O_3 48-50%, 52-54%
GMR Technologies & Industries Ltd, Ravivalasa, Distt Srikakulam	Lumps: Cr_2O_3 38-45% Fines: Cr_2O_3 45-55 %
VBC Ferro Alloys Ltd, Rudragram, Distt Medak, Telangana	Lumps: Cr_2O_3 36-52%
Chhattisgarh	
Jindal Steel & Power Ltd, Raigarh	Lumps : Cr_2O_3+38% Cr:Fe : 2 : 9 Fines : Cr_2O_3+52%, Cr:Fe : 2:6
Deepak Ferro Alloys Ltd, Urla, Distt Raipur	Lumps : Cr_2O_3 36-40% Fines : Cr_2O_3 48-52%
Gujarat	
S.A.L. Steel Ltd, Bharapur, Gandhidham	N.A.
Jammu & Kashmir	
Shree Sitaram Industries Pvt. Ltd, Distt Samba	Lumps : Cr_2O_3 40% to 52% Fines : Cr_2O_3 40% to +52%,
Tawi Chemicals Industries Distt Samba	N.A.
Odisha	
Balasore Alloys Ltd, (formerly Ispat Alloys Ltd,) Balgopalpur, Distt Balasore	Lumps : Cr_2O_3 - 40% Fines : Cr_2O_3 - 40 to +52%
Ferro Alloys Corp. Ltd, Charge Chrome Division, Randia, Distt Bhadrak	Lumps : Cr_2O_3 N.A.; Friable : Cr_2O_3 40% & above; Concentrates : N.A.
IDCOL Ferro Chrome & Alloys Ltd, Jajpur Road, Distt Cuttack	Cr_2O_3 : 42-52% SiO_2 : 6% max.
Indian Metals & Ferro Alloys Ltd, (Formerly, Indian Charge Chrome Ltd) Choudwar, Distt Cuttack	Lumps: Cr_2O_3 : 40 to >52% SiO_2 : 15% max. Fines: 40 to 50% & above
Indian Metals & Ferro Alloys Ltd, Therubali, Distt Raygada	Lumps: Cr_2O_3 : 40 to 52% Fines: Cr_2O_3 : 40 to >52% Concentrates: N.A.
Rohit Ferro Tech. Ltd, (Unit 2) Duburi, Distt Jajpur	Lumps, fines & concentrates

(Contd.)

Table - 11 (Contd.)

Industry/Name and location of plant	Specifications of ore consumed
Tata Steel Ltd, (Formerly OMC Alloys Ltd) Bamnipal, Distt Keonjhar	Cr_2O_3 : 47% min. Size : 0 to 40 mm
West Bengal	
Rohit Ferro Tech Ltd, (Unit 1) Bishnupur, Distt Bankura	Lumps, fines & concentrates
Shri Vasavi Industries Ltd, Distt Bankura	N.A.
REFRACTORY	
Chhattisgarh	
SAIL Refractories Unit, Marauda, Distt Durg	Friable lumps : Cr_2O_3 : 52 to 54% min. SiO_2 : 5% max.
Vishva Vishal Engineering Ltd, Bhilai, Durg	Cr_2O_3 : 50%, SiO_2 : 4.5% max. Fe_2O_3 : 8%
Maharashtra	
Joglekar Refractories & Ceramics (P) Ltd, Rabale, Distt Thane	Lumps Cr_2O_3 44% min. CaO < 2%, Fe_2O_3 < 21% Imported sand - 30 to +85 mesh, Cr_2O_3 45% min. SiO_2 < 1%, Fe_2O_3 < 27%
Odisha	
Aarti Steels Ltd, Plot No. 18/1B, Sector-10, CDA, Cuttack-753 014	N.A.
Balasore Alloys Ltd, Balgopalpur, Balasore	N.A.
Orissa Industries Ltd, Lathikata Works, Distt Sundargarh	Cr_2O_3 : 52 to 54% Fe_2O_3 : 15 to 18% max. SiO_2 : 3 to 5%
IFGL Refractories Ltd, Kalunga, Distt Sundargarh	Cr_2O_3 : 55% min. -16 to +22 mesh
Maruti Monolithics (Pvt) Ltd, Choudwar, Distt Cuttack	N.A.
TRL Krosaki Refractories Ltd, Belpahar, Distt Jharsududa	Cr_2O_3 : 48 to 50% min.
Shree Chem Industries (Pvt) Ltd, Mandiyakudar, Distt Sundargarh	Cr_2O_3 : 54% SiO_2 : 5 to 9% min.
Kalinga Ferro Ispat Pvt Ltd, Mandia, Distt Jajpur	Fines Cr_2O_3 : 40-52% & above,
Khemka Refractories Pvt. Ltd, Kamakhyanagar - 759 018, Distt Dhenkanal	Fines Cr_2O_3 : 52% min.
T. S. Alloys Ltd, Anantpur, Distt Cuttack	N.A.
Tamil Nadu	
Burn Standard Co. Ltd, Salem	Cr_2O_3 : 52 to 54% min., SiO_2 : 3 to 5% max. Fe_2O_3 : 15 to 18% max.

(Contd.)

Table - 11 (Concld.)

Industry/Name and location of plant	Specifications of ore consumed
C. Nataraj Ceramics & Chem. Industry Dalmiapuram, Distt Tiruchirapalli	Lumps, Cr_2O_3 + 44%. Fe_2O_3 -25%
West Bengal	
National Refractories, P.O. Salampur - 713 357, Distt Burdwan	Cr_2O_3 : 52% min., above fines
CHEMICALS	
Odisha	
Krebs & Cei (India) Ltd, Kalma, Distt Mayurbhanj	Cr_2O_3 : 48 to 55%

TRADE POLICY

The Ministry of Commerce and Industry, Department of Commerce had come out with the new Foreign Trade Policy (FTP) for the period 2015 - 2020. As per the present Export-Import Policy, the imports of chromium ore lumps, friable ores and concentrates are freely allowed. The export policy on chromite is stated as follows:

Tariff Item HS Code		Item	Export Policy	Nature of Restriction
26100000	(a)	Chrome ore other than (i) beneficiated chrome ore fines/concentrates (maximum feed grade to be less than 42% Cr_2O_3); and (ii) those categories of chrome ores mentioned as permitted through STEs (State Trading Enterprises)	Restricted	Exports permitted under licence other than categories given below
26100030 26100040	(b)	Beneficiated chrome ore fines/concentrates (maximum feed grade to be less than 42% Cr_2O_3)	STE	Export through MMTC Ltd
26100030	(c)	Chrome ore lumps with Cr_2O_3 not exceeding 40%	STE	Export through MMTC Ltd
26100090	(d)	Low silica friable/fine ore with Cr_2O_3 not exceeding 52% and silica exceeding 4%	STE	Export through MMTC Ltd
26100090	(e)	Low silica friable/fine chromite ore with Cr_2O_3 in the range from 52 to 54% and silica exceeding 4%	STE	Export through MMTC Ltd

WORLD REVIEW

World reserves of shipping-grade chromite are about 560 million tonnes in terms of chromite ore. Countries that possess sizeable quantities of reserves are Kazakhstan (41%) and South Africa (36%). These two countries together hold about 77% of world's chromite reserves. Whereas, India possesses 18 % of world reserves of chromite. The available data on world reserves of chromite (shipping grade) is shown in Table-12.

Table – 12 : World Reserves of Chromite (Shipping Grade) (By Principal Countries)

(In '000 tonnes of chromite ore)

Country	Reserves
World: Total (rounded off)	**5,60,000**
United States	620
India*	1,00,000
Kazakhstan	2,30,000
South Africa	2,00,000
Turkey	26,000
Other countries	NA

Source: *Mineral Commodity Summaries,USGS, Feb.,2019 Shipping grade - Deposit quantity and grade normalised to 45% Cr_2O_3.except for United States where grade is normalised to 7% Cr_2O_3.*

South Africa is by far the largest producer of chromite ore and concentrates followed by Turkey Kazakhstan and India. Albania, Finland, Russia and Brazil are the major producing countries.

The world production of chromite ores increased to 37.5 million tonnes in 2017 from 34.6 million tonnes recorded in the previous year. South Africa was the leading producer, contributing about 44% to the total world production, followed by Turkey (18%), Kazakhstan (17%) and India (9%) (Table-13).

Table – 13 : World Mine Production of Chromium Ores and Concentrates (By Principal Countries)

(In '000 tonnes)

Country	2015	2016	2017
World: Total (rounded off)	**34600**	**34600**	**37500**
Albania	640	713	952
Brazil	527	500[e]	500[e]
Finland[e]	946	1070	972
India	2916	3728	3481
Iran	277	342	340[e]
Kazakhstan	5383	5543	6338
Oman	443	451	436
Pakistan	330	230	350
Russia	503	485	520
South Africa	15684	14705	16587
Turkey[e]	6600	6600	6600
Zimbabwe	208	112	319[e]
Other countries	143	121	105

Source: *World Mineral Production, BGS, 2013-17.*

Upgradation of technology and advancement in beneficiation processes, such as, agglomeration of ore, pre-heating and pre-reduction of furnace feed, closed-furnace technology and recovery of chromium from slags have brought about significant changes and are now followed worldwide.

Canada

Noront Resources Ltd purchased the chromite assets of Cliffs Natural Resources Inc. (Cliffs Chromite Ontario Inc. and Cliffs Chromite Far North Inc., both indirect wholly owned subsidiaries) for $ 27.5 million.

Finland

Outokumpu's Kemi Mine, the only operating chromite ore mine in the European Union, started production in 1968 as an open pit, has become fully undergorund. Ore reserves were 48 Mt and mineral resources were estimated at 100 Mt. Ore production in 2014 was 2.4 Mt. Ore was concentrated into upgraded lumpy ore and fine concentrate (1.1 Mt in 2014), which were raw materials for Outokumpu's Ferrochrome Works in Tornio.

Russia

Tikhvin ferroalloy owned by Yildirim Group (Turkey), located near Saint Petersburg, has a ferrochromium production capacity of 1,20,000 t/yr.

South Africa

International Ferro Metals (SA) (Pty) Limited (IFMSA) operated the IFL Group's Lesedi Mine and Ferrochrome smelting operations. IFMSA attributed its financial distress to a significant decline in global commodity markets - the declining price of ferrochromium was due to the slowdown in stainless steel production caused as a result of slowdown in Chinese economy and excess production of ferrochromium in China. Additionally, ASA Metals (Pty) Ltd, a joint venture between Eastern Asia Metals Investment Co. Ltd (China) and the Limpopo Economic Development Enterprise (South Africa), operated the captive Dilokong Chrome Mine and a charge chrome production facility near Burgersfort. Hernic Ferrochrome (Pty) Ltd, the world's fourth largest integrated ferrochrome producer, based in the North-West Province, entered into an agreement with Jubilee Platinum Plc where in Jubilee was to process platinum-containing surface chromite ore tailings

generated and stockpiled by Hernic. Jubilee planned to produce chromite and platinum-group-metals concentrates from the tailings. Assore Ltd acquired African Rainbow Minerals Ltd's indirect 50% interest in Dwarsrivier Chrome Mine, subject to Government approval. Sylvania Resources Ltd recovered platinum from chromite tailings at many locations in both the eastern and western limbs of the Bushveld Igneous Complex. Sylvania's exploration at the Grasvally Chrome Operation found deposits of high-grade chromite ore. Bauba Platinum Ltd mined chromite ore for ASA Metals via its Bauba Chrome-Ore Operation at its Moeijelyk Farm. Glencore-Merafe chrome venture operations comprise several chromite ore mines, pelletising and sintering plants and ferrochromium smelters in the eastern and western limbs of the Bushveld Igneous Complex. Phase II of the Lion ferrochrome plant reached its full production potential thereby augmenting Glenocore-Merafe's ferrochromium production capacity to 2.34 Mt/yr from 6 plants that operated 22 furnaces.

Turkey

Yildirim Group operated chromite ore mines in Kazakhstan (Voskhod Chrome) and Turkey (Yildirim Holdings) and ferrochromium smelters in Russia (Tikhvin Ferroalloy), Sweden (Vargon Alloys), and Turkey (Eti Krom) Yildirim cut back chromite ore production in Elazig. Fethiye, Hatay, Kayseri and Konya owing to price decline and limited demand.

Zimbabwe

Zimasco (Pvt) Ltd, Afrochine Smelting (Pvt) Ltd and Xin Yu Mining are the major producers of ferrochromium in Zimbabwe. Afrochine, a subsidiary of Tsingshang Iron and Steel Group of China, produced ferrochromium at its Selous plant. Though Afrochine had the capacity to consume 15,000 tonnes per month (t/mo) of chromite ore, it was able to get only 2,000 to 3,000 t/mo from small-scale chromite ore producers. To encourage the expansion of chromite ore mining, the Government of Zimbabwe lifted its ban on chromite ore exports. Zimasco and ZimAlloys controlled about 80% of the chromite ore claims along the Great Dyke, as there is very little resources available. Further exploitation prospects look unlikely.

FOREIGN TRADE

Exports

Exports of chromite decreased sharply to 82 thousand tonnes in 2017-18 from 230 thousand tonnes in the previous year. Out of total chromite exported in 2017-18, the share of about 41% was of chromite concentrate, while chromite ore (others) accounted for 59%. There were exports of chrome ore lumps to only UAE in 2017-18. On the whole, exports were mainly to China (77%) and Japan (23%). In 2017-18, 56 tonnes of chromium & alloys (scrap) were exported which was 30% less from that of the preceding year. Exports of chromium & alloys (scrap) were mainly to USA (68%), Indonesia (13%), and Thailand (5%) (Tables-14 to 21).

The exports details of ferrochrome are furnished in the Review entitled, 'Ferro-alloys'.

Table – 14 : Exports of Chromite : Total (By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**230531**	**3657700**	**81835**	**1743015**
China	213373	3320174	63348	1298517
Japan	17158	337519	18485	444407
UAE	-	-	2	82
Bangladesh	-	-	++	7
Spain	-	-	++	2
Australia	++	7	-	-

Table – 15 : Exports of Chrome Ore Lumps (By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**-**	**-**	**2**	**82**
UAE	-	-	2	82

Table – 16 : Exports of Chrome Ore Concentrates (By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**149029**	**2566395**	**33367**	**789176**
Japan	17158	337519	18485	444407
China	131871	2228876	14882	344769

Table – 17 : Exports of Chrome Ore (Others) (By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**81502**	**1091305**	**48466**	**953757**
China	81502	1091298	48466	953748
Bangladesh	-	-	++	7
Spain	-	-	++	2
Australia	++	7	-	-

Table – 18 : Exports of Chromium & Alloys (Scrap) (By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**80**	**63278**	**56**	**39015**
USA	38	22282	38	22557
Thailand	++	1	3	2266
Philippines	++	66	1	837
Brazil	4	4589	4	3936
Netherlands	-	-	++	2787
Indonesia	2	1171	7	5107
Egypt	1	668	1	348
Pakistan	1	619	1	461
Kenya	++	208	1	372
France	-	-	++	145
UK	-	-	++	68
Other countries	34	33674	++	131

Table – 19 : Exports of Chromium Articles, Nes (By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**++**	**243**	**++**	**8**
Zimbabwe	-	-	++	5
UAE	++	86	-	-
Sri Lanka	++	2	++	3
Germany	++	78	-	-
Philippines	++	66	-	-
Singapore	++	11	-	-

Table – 20 : Exports of Chromium & Scrap (By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**++**	**1**	**++**	**97**
Mauritius	-	-	++	96
UAE	++	1	-	-
Iran	-	-	++	1

Table – 21 : Exports of Chromium Unwrought : Powder (By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**80**	**63035**	**56**	**36220**
USA	38	22282	38	22557
Indonesia	2	1171	7	5107
Brazil	4	4589	4	3936
Thailand	++	1	3	2266
Philippines	-	-	1	837
Pakistan	1	619	1	461
Kenya	++	208	1	372
Egypt	1	668	1	348
France	-	-	++	145
UK	-	-	++	68
Other countries	34	33497	++	123

Imports

Imports of chromite increased slightly by 4% to 161 thousand tonnes in 2017-18 from 154 thousand tonnes in the previous year. Out of total quantity of chromite imported in 2017-18, Chrome Ore Lump accounted for 73%, while concentrate and Other forms accounted for the remaining 27%. Imports were mainly from, South Africa (71%) and Oman (22%). Imports of Chrome Ore Concentrate were only from South Africa. Imports of Chromium and Alloys in 2017-18 were at 1,084 tonnes as compared to 982 tonnes in the previous year. Imports were mainly from Russia (72%), UK (18%) and China (4%). Imports of Chromium and Scrap increased to 2 tonnes in 2017-18 from negligible in 2016-17 (Tables-22 to 29).

The import details of ferrochrome are furnished in the Review entitled 'Ferro-alloys'.

Table – 22 : Imports of Chromite : Total (By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**154226**	**2105121**	**160504**	**6284861**
South Africa	82167	1405005	114131	2401432
Oman	48489	380830	35969	3670041
Pakistan	6605	100102	5420	130113
Madagascar	7503	89185	3780	56852
Netherlands	817	23968	643	16943
Myanmar	-	-	561	9476
Zimbabwe	4492	62208	++	2
Iran	1721	16901	++	2
UK	72	1498	-	-
China	5	92	-	-
Other countries	2355	25332	-	-

Table – 23 : Imports of Chrome Ore Lump (By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**103098**	**1416556**	**116449**	**2200678**
South Africa	65549	1098112	92642	1916655
Oman	30071	213118	18847	179443
Pakistan	5537	85580	4055	94073
Madagascar	973	11101	905	10505
Iran	963	8553	++	2
China	5	92	-	-

Table – 24 : Imports of Chrome Ore Concentrate (By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**11066**	**167943**	**6803**	**173381**
South Africa	5488	94114	6803	173381
UK	72	1498	-	-
Pakistan	494	5722	-	-
Zimbabwe	3496	49802	-	-
Madagascar	1001	9825	-	-
Turkey	515	6982	-	-

Table – 25 : Imports of Chrome Ore Others (By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**40062**	**520622**	**37252**	**607802**
South Africa	11130	212779	14686	311396
Oman	18418	167712	17122	187598
Madagascar	5529	68259	2875	46347
Pakistan	574	8800	1365	36040
Zimbabwe	996	12406	++	2
Netherlands	817	23968	643	16943
Myanmar	-	-	561	9476
Turkey	1839	18301	-	-
Germany	1	49	-	-
Iran	758	8348	-	-

Table – 26 : Imports of Chromium & Alloys (By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**982**	**533488**	**1084**	**616380**
Russia	744	358769	782	400181
UK	116	71167	191	118090
France	75	38911	20	10741
USA	7	27682	4	18762
Germany	1	10090	25	26749
China	20	9645	46	22550
Japan	3	5222	5	10341
Netherlands	10	4956	10	5138
Estonia	-	-	1	536
Singapore	1	3181	++	2597
Other countries	5	3865	++	695

Table – 27 : Imports of Chromium Unwrought : Powders (By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**922**	**468960**	**956**	**502946**
Russia	744	358769	762	389752
UK	77	46212	111	62407
China	16	6910	44	19269
France	60	30110	20	10741
Japan	3	5177	5	8124
USA	6	11364	4	7128
Netherlands	10	4956	10	5138
Singapore	1	2722	++	370
Czech Republic	-	-	++	17
Korea, Rep. of	5	2714	-	-
Germany	++	26	-	-

Table – 28 : Imports of Chromium Articles, Nes (By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**60**	**64528**	**128**	**113434**
UK	39	24955	80	55683
Germany	1	10064	25	26749
USA	1	16318	++	11634
Russia	-	-	20	10429
China	4	2735	2	3281
Singapore	++	459	++	2227
Japan	++	45	++	2217
Estonia	-	-	1	536
Korea, Rep. of	++	1104	++	342
Chinese Taipei/ Taiwan	-	-	++	235
Other countries	15	8848	++	101

Table – 29: Imports of Chromium & Scrap (By Countries)

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**++**	**1085**	**2**	**5668**
USA	++	162	2	4076
UK	++	923	++	966
Poland	-	-	++	626

FUTURE OUTLOOK

The current status of chromite production and consumption is on anticipated lines, but the consumption could increase alarmingly in the coming years and the country may have to depend on imports even for the domestic needs of chromite. Depletion of reserves is bound to create a serious problem for the future of the Chromite Industry in the country. An Expert Committee constituted by the Ministry of Steel, Government of India, in its recommendations put forth the need for detailed exploration of chromite in all the potential areas in Odisha, Karnataka and in the ophiolite belt of North-Eastern region with a view to prognosticate resources to a depth of 500 m in Sukinda belt and estimate resources in all other potential areas. Addressing concerns in ferrochrome production which is energy - intensive segment is also essential. Setting up of such plant must strike a cost balance between raw materials and electrical energy supply. There are other imminent issues like consistent supply of chrome ore at the right cost, steady power supply and other input materials like low phosporous met coke and good market conditions that need redressal in respect of the continuous and unscrupulous exploitation of chromite.

In coming days, increase in royalty on domestically produced chromite from 10% to 15% by Government of India is also bound to have its impact on the Industry. It will see radical transformation in the efforts undertaken to meet the challenges. Adherence to stringent pollution control norms, innovations in the process technology and plant equipment design would become inevitable for the future of the industry.

Besides, environmental concerns associated with Chromite Industry are too many which would attract considerable attention. Each and every anthropogenic activity that contributes hexavalent chromium to the environment should be regulated in such a manner so that the adverse impacts are contained within reasonable limits. For this, regular monitoring is highly essential by regulatory authorities to control the contamination caused by Cr.

As per Minerals and Metals Review January, 2019, it is mentioned that the consensus five-year outlook for chrome ore is positive. As per the latest available data, supply of chrome ore is expected to increase at a compound annual growth rate (CAGR) of 2.4 percent over the 2018 to 2022 period. Demand is expected to increase at a CAGR of 2.9 percent. This in comparision with the previous five years, where supply grew at a CAGR of 2.8 percent and demand at 3.0 percent modest reflection.