Indian Minerals Yearbook 2020

(Part- III : MINERAL REVIEWS)

59th Edition

CHROMITE

(ADVANCE RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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February, 2022

6 Chromite

Chromite is the single commercially viable ore of chromium (Cr) which is chemically known as iron chromium oxide ($FeCr_2O_4$). 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 242 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 under "General Reviews".

PRODUCTION AND STOCKS

The production of chromite was 3,929 thousand tonnes during 2019-20 which decreased by 1% as compared to 3,971 thousand tonnes in the previous year. The number of reporting mines were 22 in 2019-20 as compared to 26 in the preceding year. The share of Public Sector in total production was 21% in 2019-20 as compared to 31% in the previous year. About 20% of the total production was reported from captive mines in the current year as compared to 21% in the previous year.

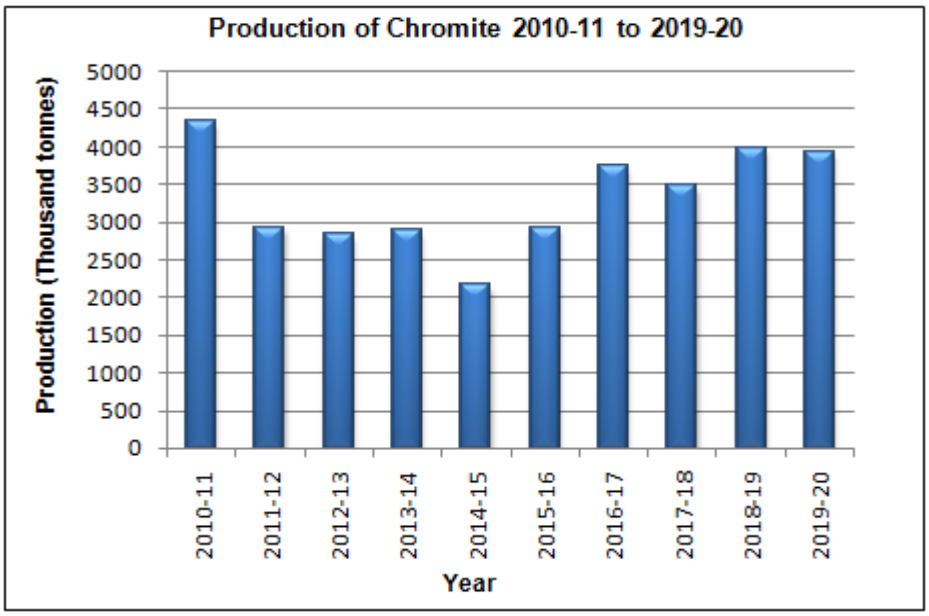

Table – 1 : Reserves/Resources of Chromite as on 1.4.2015
(By Grades/States)

(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 sole producing State for chromite, accounting for the entire production during 2019-20 and nill production was reported from Karnataka and Maharashtra.

Gradewise analysis of production during 2019-20 reveals that about 41% of the total production of chromite accounted for 52% & above Cr_2O_3 Fines grade followed by 30% least of 40–52% Cr_2O_3(lumps 2% & fines 28%) grade.

Mine-head closing stocks of chromite in 2019-20 were 2,411 thousand tonnes as compared to 2,253 thousand tonnes in 2018-19.

The average daily employment of labour in chromite mines during 2019-20 was 5,891 as against 7,245 in the previous year (Tables-2 to 8).

Table – 2 : Principal Producers of Chromite, 2019-20

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 Odisha 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, Keonjhar
Balasore Alloys Ltd, Balgopalpur, P.O. Rasalpur, Balasore - 756 020, Odisha.	Odisha	Jajpur
Misrilal Mines (P) Ltd, Mineral House, 27-A, CAMAC Street, Kolkata – 700 016, West Bengal.	Odisha	Jajpur

Table – 3 : Production of Chromite, 2017-18 to 2019-20
(By States)

(Qty in tonnes; Value in ₹'000)

State	2017-18		2018-19		2019-20 (P)	
	Qty	Value	Qty	Value	Qty	Value
India	**3480941**	**32037005**	**3970691**	**36850747**	**3929260**	**33326588**
Maharashtra	17	82	-	-	-	-
Odisha	3480924	32036923	3970691	36850747	3929260	33326588

Table – 4 : Gradewise Production of Chromite, 2018-19 (By Sectors/States/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**	**88156**	**709230**	**102754**	**1130554**	**-**	**1689043**	**250954**	**3970691**	**36850747**
Public sector	11	6460	177943	2919	408599	-	629977	11636	1237534	13489301
Private sector	15	81696	531287	99835	721955	-	1059066	239318	2733157	23361446
Karnataka	**3***	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Hassan	3*	-	-	-	-	-	-	-	-	-
Maharashtra	**1***	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Bhandara	1*	-	-	-	-	-	-	-	-	-
Odisha	**22**	**88156**	**709230**	**102754**	**1130554**	**-**	**1689043**	**250954**	**3970691**	**36850747**
Dhenkanal	4	-	3358	671	-	-	-	-	4029	14883
Jajpur	15	81696	703950	99164	1130554	-	1689043	250954	3955361	36753367
Kendujhar	3	6460	1922	2919	-	-	-	-	11301	82497

* *Only labour reported.*

Table – 5 : Gradewise Production of Chromite, 2019-20 (P) (By Sectors/States/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	**22**	**73044**	**830291**	**94838**	**1078617**	**-**	**1617150**	**235320**	**3929260**	**33326588**
Public sector	9	320	314465	238	255292		225998	13409	809722	5441198
Private sector	13	72724	515826	94600	823325	-	1391152	221911	3119538	27885390
Karnataka	**2***	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Hassan	2*	-	-	-	-	-	-	-	-	-
Odisha	**20**	**73044**	**830291**	**94838**	**1078617**	**-**	**1617150**	**235320**	**3929260**	**33326588**
Dhenkanal	3*	-	-	-	-	-	-	-	-	-
Jajpur	14	72724	830199	94600	1078617	-	1617150	235320	3928610	33321591
Keonjhar	3	320	92	238	-	-	-	-	650	4997

* *Only labour reported*

Table – 6 : Production of Chromite, 2018-19 and 2019-20 (By Frequency Groups)

(Qty in tonnes)

Production group	No. of mines		Production for the group		Percentage to total production		Cumulative percentage	
	2018-19	2019-20 (P)	2018-19	2019-20 (P)	2018-19	2019-20 (P)	2018-19	2019-20 (P)
Total	**26**	**22**	**3970691**	**3929260**	**100.00**	**100.00**	**-**	**-**
Up to 10000	14	12	4029	5870	0.10	0.15	0.10	0.15
10001—100000	3	2	109744	127064	2.76	3.23	2.86	3.38
100001 — 200000	4	3	596049	449445	15.01	11.44	17.87	14.82
200001 — 300000	2	1	457804	240907	11.53	6.13	29.4	20.95
300001 and above	3	4	2803065	3105974	70.60	79.05	100.00	100.00

Table – 7 : Mine-head Closing Stocks of Chromite, 2018-19 (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	**42587**	**1551940**	**9805**	**248942**	**285**	**359765**	**39300**	**2252624**
Karnataka	20786	-	-	-	-	-	-	20786
Maharashtra	10	-	7	-	-	-	-	17
Odisha	21791	1551940	9798	248942	285	359765	39300	2231821

Table – 8 : Mine-head Closing Stocks of Chromite, 2019-20 (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	**18269**	**1711225**	**12132**	**143057**	**285**	**503141**	**22971**	**2411080**
Karnataka	1038	-	-	303	-	-	-	1341
Maharashtra	-	-	-	-	-	-	-	-
Odisha	17231	1711225	12132	142754	285	503141	22971	2409739

MINING & TRANSPORT

At present, mining operations for chromite are restricted in the Sukinda ultramafic belt, in the Baula Nausahi chromite belt in Odisha and in Hassan district of Karnataka. 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.

ENVIRONMENT

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 1,000 times more.

The inhalation of chromium compounds has been associated with the development of cancer among 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%.

Protection of environment has become a major issue presently. The major environmental impacts of mining are (i) deforestation (ii) land damage (iii) water pollution and hydrological damage (iv) air pollution (v) noise pollution (vi) ground vibration and fly rock problem (vii) visual impacts, etc.

Deforestation takes place at actual site of an opencast mines and also where mineral and over-burden dumps are created or where service buildings and roads are built. Land damage takes place in opencast mining while exposing the mineral and in underground mining due to surface subsidence. In addition, land damage also takes place due to siting of surface dump of mineral, overburden refuse tips and formation of tailing dams.

After enforcement of MCDR,1988 there was afforestation in metalliferous mines in order to stabilise and reduce the impact of mining. IBM did play a major role in the restoration of mine environment. Plantation trees and other afforestation efforts to improve the environment were carried out regularly since 1989-90 and are still in practice.

CONSUMPTION

The consumption of chromite decreased by about 2% to 2.72 million tonnes in 2019-20 from 2.77 million tonnes in 2018-19. The most consuming industry was Ferroalloys/Charge chrome Industry (96%). 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 from 2017-18 to 2019-20 is furnished in Table- 9.

Table – 9 : Estimated Consumption* of Chromite 2017-18 to 2019-20 (By Industries)

(In tonnes)

Industry	2017-18	2018-19 (R)	2019-20 (P)
All Industries	**2575200(45)**	**2774800(42)**	**2718900(41)**
Chemical	5000	5100	5300
Concentrates (Chrome ore/ chromite)	60700	112100	99900
Ferroalloys (including Charge chrome)	2499200	2639800	2597500
Refractory (including iron & steel)	9300	16700	15800
Others (foundry, calcination)	1000	1100	400

Figures rounded off

** Includes actual reported consumption and/or estimates made wherever required. Owing to Paucity of data, the coverage may not be complete.*

(): Number of plant reported/estimated.

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. Chromium containing scrap can substitute for ferrochromium in some metallurgical uses. 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 Reaffirmed March 2019. IS: 10819-1999 (First Revision, Reaffirmed in January 2017) for specifications of chromite for Refractory Industry, IS: 4737-1982 (First Revision, Reaffirmed January 2021) for specification of chromite for Chemical Industry and IS : 6788: 1973 (Re-affirmed Feb.2019) for specification of chromite sand for Foundry Industry.

INDUSTRY

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

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 per cent. Around 2.5 tonnes chrome ore with an estimated power consumption of about 4,500 kWh is required to produce one tonne of ferrochrome.

Ferro Alloys Corpn. Ltd, Garividi, Andhra Pradesh; GMR Technologies & Industries 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.

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 charge chrome in the country have a total capacity of about 1,82,500 tpy. Tata Steel with its charge chrome plant at Bamnipal, Odisha, has a capacity of 55,000 tpy, while FACOR has a capacity of 65,000 tpy charge chrome at its Randia Plant, Bhadrak district, Odisha. Indian Metals & Ferro Alloys Ltd (IMFA), Cuttack district, Odisha, has an installed capacity of 62,500 tonnes per year.

Vishnu Chemicals Ltd has plants at Medak, Visakhapatnam (Andhra Pradesh) and Bhilai (Chhattisgarh) which produces chromium products, such as, sodium dichromate (70,000 tonnes per year), basic chromium sulphate, chromic acid (1,000 tonnes per year) and potassium dichromate (1,000 tonnes). 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.

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-10.

Table – 10 : 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	
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%
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
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%
Jammu & Kashmir	
Shree Sitaram Industries Pvt. Ltd, Distt Samba	Lumps : Cr_2O_3 40% to 52% Fines : Cr_2O_3 40% to +52%,
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-10 (Concld)

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
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	
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
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.
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.
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 Foreign Trade Policy (FTP) for the period 2015-2020. As per the present Export-Import Policy, ITC(HS), 2017 Schedule-2 " Export Policy" the imports of chromium ore lumps, friable ores and concentrates are freely allowed. The export policy on chromite is stated as follows: Chapter 2601 " Iron ores and concentrates, including roasted iron pyrites.

Tariff Item HS Code	Item	Export Policy
26100000	(a) Chrome ore lump containing (i) 47% Cr_2O_3 and above	-
26100020	(b) Chrome ore lumps containing 40% or more but less than 47% Cr_2O_3	-
26100030	(c) Chrome ore lumps with Cr_2O_3 below 40%	-
26100040	(d) Chrome ore friable and conc. fixes containing 47% Cr_2O_3 and above	-
26100090	(e) Other	

WORLD REVIEW

World reserves of Shipping-grade chromite are about 570 million tonnes in terms of chromite ore. Countries that possess sizeable quantities of reserves are Kazakhstan (40%) and South Africa (35%). These two countries together hold about 75% of world's chromite reserves. India possesses 18% and while Turkey accounts for 5% of the world reserves of chromite. The available data on world reserves of chromite (Shipping-grade) is furnished in Table-11.

Table – 11 : World Reserves of Chromite (Shipping Grade) (By Principal Countries)**

(In '000 tonnes of chromium content)

Country	Reserves
World: Total (rounded off)	**570000**
Finland	13000
India*	100000
Kazakhstan	230000
South Africa	200000
Turkey	26000
USA	620
Other countries	NA

Source: *USGS, Mineral Commodity Summaries, 2021*
***Shipping grade - Reserves unit are thousand tonnes of Shipping-grade chromite ore which is Deposit quantity and grade normalised to 45% Cr_2O_3 except for United States where grade is normalised to 7% Cr_2O_3 and finland where grade is normalised to 26% Cr_2O_3 .*

*NA-Not available. *: Reserves/resources of chromite in the country as on 1.4.2015 as per NMI database based on UNFC system have been placed at 344.02 million tonnes.*

The world mine production of chromite ores & concentrates increased by 3% to 38.6 million tonnes in 2019 from 37.5 million tonnes recorded in the previous year. South Africa was the leading producer contributing about 46% to the total world production followed by Kazakhstan (18%), India (10%), Turkey (9%), Zimbabwe (4%), Albania & Finland (3% each) and Russia & Oman (2% each) (Table-12).

Table – 12 : World Mine Production of Chromium Ores and Concentrates (By Principal Countries)

(In '000 tonnes)

Country	2017	2018	2019
World: Total (rounded off)	**33900**	**37500**	**38600**
South Africa	16587	17829	17664
Kazakhstan	6313	6889	7019
India[(e)**]	3481	3971	3837
Turkey	2554	2897	3364
Zimbabwe	689	895	1550
Albania	808	1143	1200*
Finland[(f)]	972	1099	1184
Russia	434	469	698
Oman	632	885	608
Other countries	1436	1386	1226

Source: *BGS World Mineral Production, 2015-19*
**: Estimate, e: Years ends 31 March following that stated, f: Concentrates.*
***: production of chromite n india 2017-18, 2018-19 and 2019-20 was 3.48 million tonnes, 3.97 million tonnes and 3.93 million tonnes respectively.*

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. For generalised view of the development in various countries, the countrywise description sourced from the latest available publication of USGS 'Mineral Yearbook 2018' chromium (Advance Release) is furnished below:

Albania

Albania produced an estimated 9,60,000 tonnes of chromite ore in 2018 as against 9,50,181 tonnes in 2017. Ferrochromium production was estimated at 60,000 tonnes in 2018 as against 49,000 tonnes in 2017. Chromite ore and ferrochromium production increased in the past several years owing to increased investment in AlbChrome (Tirana), the leading chromite ore and ferrochromium producer in Albania.

Kazakhstan

Kazakhstan produced 66,88,700 tonnes of chromite ore in 2018 as against 63,13,300 tonnes (revised) in 2017 and an estimated 16,00,000 tonnes of ferrochromium in 2018 as compared with 16,40,300 tonnes (revised) in 2017. Kazakhstan was the third-leading producer of chromite ore and ferrochromium in the world.

Finland

Finland's production increased in 2018. The values for production in 2014 through 2017 have been revised and are now about twice as much as previously reported

South Africa

South Africa was the world's leading producer of chromite ore in 2018. South Africa produced 1,76,17,099 tonnes of chromite ore in 2018 compared with 1,65,47,717 tonnes (revised) in 2017 and an estimated 39,00,000 tonnes of ferrochromium in 2018 compared with an estimated 36,00,000 tonnes in 2017. Afarak Group Plc (Finland) announced a transformer failure of a submerged arc furnace that produces ferrochromium in August at its Mogale Alloys processing plant. As a result, Mogale shut down the furnace, and repairs were expected to take up to 14 weeks to complete. Mogale anticipated a 7,000-tonnes/year reduction in ferrochromium capacity and production

Zimbabwe

Zimbabwe produced 8,94,661 tonnes of chromite ore in 2018 as against 6,88,838 tonnes (revised) in 2017 and an estimated 1,80,000 tonnes of ferrochromium in 2018 compared with 1,42,800 tonnes in 2017.

Balasore Alloys Ltd. (India) agreed to acquire a 70% stake in Zimbabwe Alloys Ltd. (ZimAlloys) (Gweru) in January to increase domestic and overseas production capacity. The arrangement was sanctioned by the High Court of Zimbabwe. The investment also settled ZimAlloys' debt of $50 million to creditors. With the debt cleared, ZimAlloys planned to refurbish and restart its blast furnaces within 18 months.

Brazil

Brazil produced an estimated 5,50,000 tonnes of chromite ore in 2018, unchanged from the 2017 revised estimate. Ferrochromium production was 1,75,061 tonnes in 2018 compared with 1,71,531 tonnes in 2017. Companhia de Ferro Ligas da Bahia owned more than 95% of chromite deposits operated in Brazil. Ferbasa invested $2.1 million in its "Hard Lump" project to improve treatment and mining processes in chromite ore production. An investment of $6.1 million was also allocated to machinery and equipment. Ferbasa decided to decrease its sales volume in 2018 compared to sales in 2017 owing to the decrease in the global prices of chromite ore (Companhia de Ferro Ligas da Bahia, 2019).

China

China produced an estimated 30,000 tonnes of chromite ore in 2018, unchanged from the 2017 estimate, and an estimated 52,50,000 tonnes of ferrochromium compared with a revised estimate of 49,40,000 tonnes in 2017. China was the leading producer of ferrochromium in 2018.

In response to requests from the stainless-steel billet and hot-rolled sheet and Coil Industry in China, the Ministry of Commerce of the People's Republic of China announced an investigation into imports of

stainless-steel billets and stainless steel hot-rolled coil from the European Union, Indonesia, Japan and the Republic of Korea. The investigation was set to begin on July 23, 2018, and would run for 1 year but could extend into 2020 depending on special circumstances.

FOREIGN TRADE

Exports

Exports of chromite (total) decreased substantially by 14% to 33.90 thousand tonnes in 2019-20 from 39.27 thousand tonnes in the previous year. Out of total chromite exported in 2019-20, the share of chromite concentrate was about 90%, while chromite ore (others) accounted for 10%. Exports of chrome ore concentrate were almost fully to China in 2019-20. Export of chrome Ore (other) increased substantially by 23% to 3,433 tonnes in 2019-20 from 2,788 tonnes in the preceding year.

Table – 13 : Exports of Chromite : Total (By Countries)

Country	2018-19 (R)		2019-20 (R)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**39273**	**1337693**	**33898**	**867910**
China	17492	602026	32069	795605
Spain	702	30674	1500	63405
South Africa	-	-	292	8871
Nepal	-	-	37	30
Japan	21051	703583	-	-
Saudi Arabia	21	1287	-	-
UAE	6	90	-	-
UK	1	33	-	-

Figures rounded off

Table – 14 : Exports of Chrome Ore Lumps (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1500**	**53223**	**-**	**-**
China	1500	53223	-	-
Other countries	-	-	-	-

Figures rounded off

In 2019-20, 159 tonnes of chromium & alloys were exported to various countries which was 3 times more from that of the preceding year. Exports of chromium & alloys were mainly to USA (84%), Peru (9%) and UAE (2%). The exports of chromium & scrap was negligible. Exports of chromium unwrought (powder) increased by more than three times to 159 tonnes in 2019-20 from 47 tonnes in the preceding year (Tables-13 to 20). The details of exports of ferrochrome are furnished in the Review entitled, 'Ferroalloys'.

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**34985**	**1167942**	**30465**	**735434**
China	13913	463072	30377	732910
South Africa	-	-	88	2523
Japan	21051	703583	-	-
Saudi Arabia	21	1287	-	-

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**2788**	**116528**	**3433**	**132477**
Spain	702	30674	1500	63405
China	2079	85731	1692	62694
South Africa	-	-	204	6348
Nepal	-	-	37	30
UAE	6	90	-	-
UK	1	33	-	-

Figures rounded off

Table – 17 : Exports of Chromium & Alloys (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**47**	**60583**	**159**	**112565**
USA	22	23277	133	87667
Peru	6	6774	14	14996
Brazil	6	7009	2	2619
Saudi Arabia	-	-	2	1853
UAE	++	251	3	1768
UK	1	986	1	1055
Taiwan	1	1069	1	717
Kenya	1	505	1	657
Egypt	-	-	++	282
Pakistan	1	1053	++	274
Other countries	9	19660	1	676

Figures rounded off

Table – 18 : Exports of Chromium Articles, Nes (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**++**	**58**	**++**	**8**
Nigeria	**-**	**-**	**++**	4
Bhutan	**++**	**3**	++	4
South Africa	**-**	**-**	**++**	++
Mauritius	**++**	**47**	**-**	-
Nepal	++	4	-	-
Canada	**++**	3	**-**	-
Sri Lanka	++	1	-	-

Figures rounded off

Table – 19 : Exports of Chromium & Scrap (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**++**	**198**	**++**	**30**
Nepal	-	-	++	30
Korea, Rep. of	-	-	++	++
USA	**++**	189	-	-
Azerbaijan	**++**	8	-	-

Figures rounded off

Table – 20 : Exports of Chromium Unwrought : Powder (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**47**	**60328**	**159**	**112526**
USA	22	23087	133	87667
Peru	6	6774	14	14996
Brazil	6	7009	2	2619
Saudi Arabia	-	-	2	1853
UAE	++	251	3	1768
UK	1	986	1	1055
Taiwan	1	1069	1	717
Kenya	1	505	1	657
Egypt	-	-	++	282
Pakistan	1	1053	++	274
Other countries	9	19594	1	638

Figures rounded off

Imports

Imports of chromite (total) decreased by 23% to 124.69 thousand tonnes in 2019-20 from 162.66 thousand tonnes in the previous year. Imports were mainly from South Africa (80%), Oman (11%) and Singapore (3%). Out of total quantity of chromite imported in 2019-20, chrome ore lump accounted for 65%, while concentrate and Other forms accounted for the remaining 35%. Imports of chrome ore lump were mainly from South Africa (69%), Oman (17%) and Singapore (5%). Imports of chrome ore concentrate were solely from South Africa. Imports of chromium & alloys in 2019-20 were at 1,514 tonnes as compared to 1,268 tonnes in the previous year. Imports of chromium & alloys were mainly from Russia (27%), UK (25%), Netherlands (22%). Imports of chromium & scrap were only one tonne in 2019-20 as compare to negligible in 2018-19 (Tables-21 to 28).

The import details of ferrochrome are furnished in the Review entitled 'Ferroalloys'.

Table – 21 : Imports of Chromite : Total (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**162663**	**3154446**	**124693**	**2065046**
South Africa	109688	2522850	99301	1757431
Oman	32852	310336	13855	141143
Singapore	-	-	3844	51313
Madagascar	16090	226911	2794	40226
Switzerland	-	-	2546	31249
Zimbabwe	368	5707	1819	27451
UAE	844	34932	324	7951
Netherlands	326	11593	73	3302
Hong Kong	-	-	54	2009
Saudi Arabia	-	-	54	1463
Other countries	2496	42118	29	1508

Figures rounded off

Table – 22 : Imports of Chrome Ore Lump (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**128402**	**2419355**	**80819**	**1300165**
South Africa	95670	2022122	55907	1007319
Oman	13828	125264	13855	141143
Singapore	-	-	3844	51313
Madagascar	16090	226911	2794	40226
Switzerland	-	-	2546	31249
Zimbabwe	368	5702	1819	27451
Saudi Arabia	-	-	54	1463
Pakistan	2421	38511	-	-
UAE	26	846	-	-

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**2970**	**104952**	**891**	**24896**
South Africa	2970	104952	891	24896

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**31291**	**630138**	**42984**	**739986**
South Africa	11048	395775	42503	725216
UAE	818	34087	324	7951
Netherlands	326	11593	73	3302
Hong Kong	-	-	54	2009
China	13	731	23	953
Germany	-	-	6	554
Spain	-	-	++	1
USA	-	-	++	++
Oman	19024	185072	-	-
Malta	54	2315	-	-
Other countries	8	567	-	-

Figures rounded off

Table – 25 : Imports of Chromium & Alloys (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1268**	**1031626**	**1514**	**923958**
Russia	504	394775	411	231277
UK	128	115390	376	206314
Netherlands	70	51783	337	184070
Austria	++	228	200	137716
USA	32	38970	32	48593
China	362	277513	76	39722
France	-	-	31	23988
Germany	5	23537	4	18984
Belgium	25	14154	21	14425
UAE	18	16135	24	13284
Other countries	125	99142	2	5584

Figures rounded off

Table – 26 : Imports of Chromium Unwrought : Powders (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1121**	**867135**	**1416**	**819169**
Russia	504	394775	411	231277
Netherlands	70	51680	337	184070
UK	38	28800	335	171329
Austria	-	-	200	136916
USA	26	17563	32	37001
China	336	257919	54	26794
France	-	-	21	15113
UAE	18	16135	24	12942
Japan	5	9102	2	3302
Belgium	5	3413	1	425
Other countries	119	87749	-	-

Figures rounded off

Table – 27 : Imports of Chromium Articles, Nes (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**147**	**164173**	**98**	**102997**
UK	91	86589	40	34564
Germany	5	23501	4	18754
Belgium	20	10741	2	14000
China	25	19594	22	12928
USA	6	21407	++	11593
France	-	-	10	8875
Korea, Rep. of	-	-	++	734
Singapore	++	842	++	597
Hong Kong	++	18	++	382
Japan	++	1137	++	313
Other countries	++	344	++	257

Figures rounded off

Table – 28: Imports of Chromium & Scrap (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**++**	**318**	**1**	**1792**
Austria	-	-	++	799
UK	-	-	**1**	420
UAE	-	-	++	342
Germany	++	36	++	230
Korea, Rep. of	++	1	-	-
Turkey	++	281	-	-

Figures rounded off

FUTURE OUTLOOK

The current status of chromite production and consumption is on anticipated lines, but the consumption could increase enormously 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.

Adherence to stringent pollution control norms, innovations in the process technology and plant equipment design would become inevitable for the future of the industry.

As per the latest available data, supply of chrome ore is expected to increase at a compound annual growth rate (CAGR) of 2.4 per cent over the 2018 to 2022 period. Demand is expected to increase at a CAGR of 2.9 per cent. This is in comparision with the previous five years, where supply grew at a CAGR of 2.8 per cent and demand at 3.0 per cent modest reflection.