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CHROMITE

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GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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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 1.4.2020 has been estimated at 332 million tonnes with 79 million tonnes as "Reserves" (24%) and 253 million tonnes as "Remaining Resources" (76%). 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 28% resources followed by Beneficiable grade (24%), Ferrochrome grade (17%), Refractory grade (16%) and Unclassified grade (10%). Low, Others, and Not-known grades together account for remaining 4% (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 3,786 thousand tonnes during 2021-22 which increased by 34% as compared to 2,830 thousand tonnes in the previous year. The number of reporting mines were 20 in 2021-22 as compared to 24 in the preceding year. The share of Public Sector in total production was 31% in 2021-22 as compared to 40% in the previous year. About 17% of the total production was reported from captive mines in the current year as compared to 22% in the previous year. (Figure - 1)

Figure -1

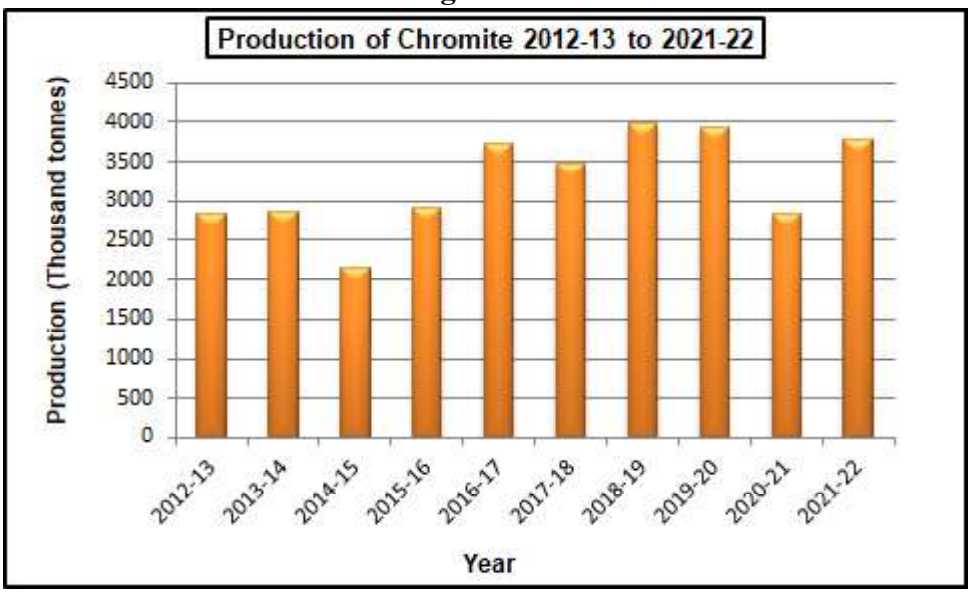

Table – 1 : Reserves/Resources of Chromite as on 1.4.2020 (P)
(By Grades/States)

(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	**40635**	**15229**	**22672**	**78535**	**52696**	**10545**	**44395**	**1630**	**53008**	**70440**	**20435**	**253150**	**331685**
By Grades													
Refractory	6830	8592	11241	26663	14981	2902	3053	70	430	4238	-	25675	52338
Charge chrome	21426	3130	7340	31896	20723	4651	5205	140	26395	4699	-	61815	93711
Low	4480	-	-	4480	2545	27	-	-	-	3713	-	6284	10764
Beneficiable	7515	3507	4091	15113	11365	2964	14885	1335	14059	20805	-	65413	80526
Ferrochrome	-	-	-	-	1519	-	21083	75	11801	22951	-	57429	57429
Others	-	-	-	-	-	-	-	-	15	-	-	15	15
Unclassified	385	-	-	384	1562	-	169	9	308	13856	19889	35793	36177
Not-known	-	-	-	-	1	1	1	-	-	177	546	725	725
By States													
Andhra Pradesh	-	-	-	-	-	-	-	-	-	-	-	-	-
Jharkhand	-	-	-	-	-	-	-	15	98	623	-	736	736
Karnataka	176	340	323	499	474	378	54	-	20	392	-	1317	1817
Maharashtra	5	48	23	5	5	-	5	43	67	418	-	533	538
Manipur	-	-	-	-	3	21	52	-	504	6077	-	6657	6657
Nagaland	-	-	-	-	-	-	-	-	-	3200	-	3200	3200
Odisha	40453	15229	22349	78031	52215	10146	44289	1565	52304	59284	20435	240237	318269
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 2021-22.

Gradewise analysis of production during 2021-22 reveals that about 44% of the total production of chromite accounted for 40%-52% Cr_2O_3 (lumps & fines) followed by 28% accounted for below 40% Cr_2O_3(lumps & fines) grade and 27% accounted for 52% & above Cr_2O_3 fines grade.

Mine-head closing stocks of chromite in 2021-22 were 2,988 thousand tonnes as compared to 2,764 thousand tonnes in 2020-21.

The average daily employment of labour in chromite mines during 2021-22 was 4,703 as against 4,289 in the previous year (Tables-2 to 8).

Table – 2 : Principal Producers of Chromite, 2021-22

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 Keonijhar
Indian Metals & Ferro Alloys Ltd, IMFA Building, Bomikhal, P.O.-Rasulgarh, Rasulgarh, Bhubaneswar – 751 010, Odisha.	Odisha	Jajpur,
Balasore Alloys Ltd, Balgopalpur, Dist. Balasore - 756 020, Odisha.	Odisha	Jajpur
Ferro Alloys Corporation Ltd., Charge Chrome Plant, D.P.Nagar, Randia, Bhadrak-756135 Odisha.	Odisha	Jajpur

Table – 3 : Production of Chromite, 2019-20 to 2021-22
(By States)

(Qty in tonnes; Value in ₹'000)

State	2019-20		2020-21		2021-22 (P)	
	Qty	Value	Qty	Value	Qty	Value
India	**3929260**	**32134395**	**2830413**	**21862796**	**3785625**	**47298073**
Odisha	3929260	32134395	2830413	21862796	3785625	47298037

Table – 4 : Gradewise Production of Chromite, 2020-21 (By Sectors/States/Districts)

(Qty in tonnes; Value in ₹'000)

State/ District	No. of mines	Production by Grades : Cr_2O_3 Content								
		Below 40%		40—52%		52% & Above		Concentrates	Total	
		Lumps	Fines	Lumps	Fines	Lumps	Fines		Quantity	Value
India	**24**	**71681**	**748478**	**131954**	**2229711**	**-**	**615393**	**33196**	**2830413**	**21862796**
Public sector	8	-	182082	-	732759	-	208901	-	1123742	10511219
Private sector	16	71681	566396	131954	496952	-	406492	33191	1706671	11351577
Karnataka	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Hassan	2*	-	-	-	-	-	-	-	-	-
Odisha	**22**	**71681**	**748478**	**131954**	**1229711**	**-**	**615393**	**33196**	**2830413**	**21862796**
Dhenkanal	3*	-	-	-	-	-	-	-	-	-
Jajpur	16	71681	748478	131954	1229711	-	615393	33196	2830413	21862796
Keonjhar	3*	-	-	-	-	-	-	-	-	-

* *Only labour reported*

Table – 5 : Gradewise Production of Chromite, 2021-22(P) (By Sectors/States/Districts)

(Qty in tonnes; Value in ₹'000)

State/ District	No. of mines	Production by Grades : Cr_2O_3 Content								
		Below 40%		40—52%		52% & Above		Concentrates	Total	
		Lumps	Fines	Lumps	Fines	Lumps	Fines		Quantity	Value
India	**20**	**69402**	**991591**	**168510**	**1494730**	**-**	**1004348**	**57044**	**3785625**	**47298073**
Public sector	9	-	159424	-	751176	-	253155	-	1163755	19042093
Private sector	11	69402	832167	168510	743554	-	751193	57044	2621870	28255980
Karnataka	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Hassan	2*	-	-	-	-	-	-	-	-	-
Odisha	**18**	**69402**	**991591**	**168510**	**1494730**	**-**	**1004348**	**57044**	**3785625**	**47298073**
Dhenkanal	3*	-	-	-	-	-	-	-	-	-
Jajpur	14	69402	991591	168510	1494730	-	1004348	57044	3785625	47298073
Kendujhar	1*	-	-	-	-	-	-	-	-	-

* *Only labour reported.*

Table – 6 : Production of Chromite, 2020-21 and 2021-22 (By Frequency Groups)

(Qty in tonnes)

Production group	No. of mines		Production for the group		Percentage to total production		Cumulative percentage	
	2020-21	2021-22 (P)	2020-21	2021-22 (P)	2020-21	2021-22 (P)	2020-21	2021-22 (P)
Total	**24**	**20**	**2830413**	**3785625**	**100.00**	**100.00**	**-**	**-**
Up to 10000	14	10	-	-	-	-	-	-
10001—100000	4	3	233023	150195	8.23	3.97	8323	3.97
100001 — 200000	2	1	307980	163764	10.88	4.33	19.11	8.30
200001 — 300000	2	3	521820	761695	18.44	20.12	37.55	28.42
300001 and above	2	3	1767590	2709971	62.45	71.59	100.00	100.01

Table – 7 : Mine-head Closing Stocks of Chromite, 2020-21 (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	**27423**	**1863074**	**11300**	**590048**	**285**	**244964**	**26814**	**2763908**
Karnataka	1331	-	-	-	-	-	-	1331
Odisha	26092	1863074	11300	590048	285	244964	26814	2762577

Table – 8 : Mine-head Closing Stocks of Chromite, 2021-22 (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	**14394**	**2052129**	**24453**	**630594**	**285**	**244124**	**21881**	**2987860**
Karnataka	1038	-	-	303	-	-	-	1341
Odisha	13356	2052129	24453	630291	285	244124	21881	2986519

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. OMC is operating a chrome ore Beneficiation plant (COBP) at its South kaliapani lease having capacity 1.5 lakh tonne/year. OMC has decided to go for another COBP of the same capacity. The work is in the final stage of completion of construction. To recover a significant amount of chrome values from the talling of COB plant, OMC conducted a technical piolet plant study through NML.Based on the report of NML, DPR has been prepared and based on the DPR,decision was taken for execution of the project.

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.

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) 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; 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 mining Ltd (TSML) has a ferro-chrome plants in Athagarh and Gopalpur in Odisha. TSML scaled up ferro-chrome production to 373 thousand tonnes in 2021-22 from 37 thousand tonnes in 2020-21, 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.

(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.

The Central Government amends Export Policy of items under HS code 2610 related to Chrome ore vide notification No. 13/2023 dated 22nd June 2023 is as under;

Tariff Item HS Code	Item Description	Export Policy	Policy Condition	Revised Export Policy	Revised Policy Condition
26100000	(a) Chrome ore lump containing (i) 47% Cr_2O_3 and above	Free	-	Restricted	
26100020	(b) Chrome ore lumps containing 40% or more but less than 47% Cr_2O_3	Free	-	Restricted	
26100030	(c) Chrome ore lumps with Cr_2O_3 below 40%	STE	Export through MMTC Limited	Restricted	Export permitted under
26100040	(d) Chrome ore friable and conc. fixes containing 47% Cr_2O_3 and above	STE	Export through MMTC Limited	Restricted	Authersaition
26100090	(e) Other	STE	Export through MMTC Limited	Restricted	

WORLD REVIEW

World reserves of Shipping-grade chromite are about 560 million tonnes in terms of chromiun content. Countries that possess sizeable quantities of reserves are USA (40%) and South Africa (36%). These two countries together hold about 76% of world's chromite reserves. India possesses 18% while Turkey accounts for 4% of the world reserves of chromite. The available data on world reserves of chromite (Shipping-grade) is furnished in Table-11.

The world mine production of chromite ores & concentrates increased by 18% to 35.03 million tonnes in 2021 from 29.77 million tonnes recorded in the previous year. South Africa was the leading producer contributing about 52% to the total world production followed by Kazakhstan (18%), Turkey (8%), India (7%), Zimbabwe & Finland (3% each) and Russia & Albania (2% each) (Table-12).

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

(In '000 tonnes of chromium content)

Country	Reserves
World: Total (rounded off)	**560000**
Kazakhstan	230000
South Africa	200000
India	100000
Turkey	26000
Finland	8300
United States	630
Other countries	NA

Source: *USGS, Mineral Commodity Summaries, 2023*
***Shipping grade-Reserves unit are thousand metric 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 1.4.2020 as per NMI database based on UNFC system have been placed at 331.69 million tonnes.*

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

(In '000 tonnes)

Country	2019	2020	2021
World:Total (roundedoff)	**38613047**	**29779224**	**35073322**
South Africa	17664239	13196880	18435250
Kazakhstan	7019000	6327000	6192000
Turkey	3363791	2128669	2779467
India**	3929260	2863869	2560000
Zimbabwe	1550064	1272139	1244300
Finland	1183862	1131336	1141184
Russia	698000	689000	689000
Albania	1288315	626627	650200
Pakistan	467400	404800	467100
Other countries	1449116	1138904	914821

Source: *BGS World Mineral Production, 2017-21*
***: production of chromite in india 2019-20, 2020-21 and 2021-22 was 3.92 million tonnes, 2.83 million tonnes and 3.78 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 by 8% to 2.62 thousand tonnes in 2021-22 from 2.87 thousand tonnes in the previous year. Out of total chromite exported in 2021-22, the share of chromite concentrate was Nigligible while chromite ore (others) accounted for 99%. Exports of chrome ore (others) were almost fully to China in 2021-22. Export of chrome Ore (other) decreased to 2,614 tonnes in 2021-22 from 2,668 tonnes in the preceding year.

In 2021-22, 284 tonnes of chromium & alloys were exported to various countries. Exports of chromium & alloys were mainly to USA (69%), UAE (15%) and Netherland(7%). The exports of chromium & scrap was negligible. Exports of chromium unwrought (powder) was increased to 284 tonnes in 2021-22 from 158 tonnes in the preceding year (Tables-13 to 20). The details of exports of ferrochrome are furnished in the Review entitled, 'Ferroalloys'.

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**2872**	**71979**	**2625**	**89710**
China	2716	65714	2614	76845
USA	-	-	7	12638
Saudi Arabia	-	-	4	200
Nepal	2	84	++	14
Oman	-	-	++	13
UK	-	-	++	++
Spain	100	4602	-	-
UAE	54	1579	-	-

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**204**	**3104**	**-**	**-**
China	204	3104	-	-

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**2668**	**68875**	**2614**	**76859**
China	2512	62610	2614	76845
Nepal	2	84	++	14
UK	-	-	++	++
Spain	100	4602	-	-
UAE	54	1579	-	-

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**-**	**-**	**11**	**12851**
USA	-	-	7	12638
Saudi Arabia	-	-	4	200
Oman	-	-	++	13

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**168**	**119489**	**284**	**229068**
USA	136	83691	195	152031
U A E	3	1904	42	37241
Netherlands	-	-	20	17391
Brazil	12	8138	17	14745
Indonesia	1	1298	4	2758
Saudi Arabia	1	61	3	2188
Egypt	1	573	2	1489
Kenya	1	414	1	599
Japan	-	-	++	263
Poland	-	-	++	142
Other countries	13	23410	++	221

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**10**	**21035**	**++**	**156**
Saudi Arabia	-	-	++	130
Nigeria	-	-	++	22
South Africa	-	-	++	2
Sri Lanka	-	-	++	2
Nepal	10	21000	-	-
Italy	++	34	-	-
Australia	++	1	-	-

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**++**	**32**	**++**	**265**
Japan	-	-	++	263
Iran	-	-	++	2
Kenya	++	19	-	-
Qatar	++	11	-	-
UAE	++	2	-	-

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**158**	**98422**	**284**	**228647**
USA	136	83691	195	152031
U A E	3	1902	42	37241
Netherlands	-	-	20	17391
Brazil	12	8138	17	14745
Indonesia	1	1298	4	2758
Saudi Arabia	1	61	3	2058
Egypt	1	573	2	1489
Kenya	1	395	1	599
Poland	-	-	++	142
Jamaica	-	-	++	78
Other countries	3	2364	++	115

Figures rounded off

Imports

Imports of chromite (total) increased by 57% to 245.71 thousand tonnes in 2021-22 from 156.211 thousand tonnes in the previous year. Imports were mainly from South Africa (71%), Switzerland (19%) and Austria (3%). Out of total quantity of chromite imported in 2021-22, chrome ore lump accounted for 45%, while concentrate and Other forms accounted for 53%. Imports of chrome ore lump were mainly from South Africa (35%), and Switzerland (42%). 93% of the imports of chrome ore concentrate were from South Africa only. Imports of chromium & alloys in 2021-22 were at 1,451 tonnes as compared to 1,329 tonnes in the previous year. Imports of chromium & alloys were mainly from Russia (52%), China (15%) and UK (8%). Imports of chromium & scrap were 102 tonnes in 2021-22 as compared to neglible in 2020-21 (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	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**156211**	**2257733**	**245710**	**4232459**
South Africa	110250	1654869	173586	3192808
Switzerland	6070	87789	45991	606665
Austria	-	-	6155	108338
Singapore	-	-	7684	96931
Turkey	4450	56880	4234	91682
Oman	4319	47871	3218	56133
UAE	561	12416	2384	33439
Monaco	-	-	1952	23690
Netherlands	150	7458	318	14372
Germany	2	222	15	1992
Other countries	30409	390228	173	6409

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**78845**	**1148209**	**110544**	**1809263**
South Africa	33897	570767	39295	800963
Switzerland	6070	87789	45991	606665
Austria	-	-	6155	108338
Singapore	-	-	7684	96931
Turkey	4450	56880	4234	91682
Oman	4319	47871	3218	56133
UAE	-	-	1990	24395
Monaco	-	-	1952	23690
Canada	-	-	25	466
Canada	-	-	25	466
Mozambique	30109	384902	-	-

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**4013**	**93937**	**4987**	**126819**
South Africa	3726	89662	4987	126819
Zimbabwe	287	4275	-	-

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**73353**	**1015587**	**130179**	**2296377**
South Africa	72627	994440	129304	2265026
Netherlands	150	7458	318	14372
UAE	561	12416	394	9044
Germany	2	222	15	1992
USA	1	319	18	1958S
Saudi Arabia	-	-	81	1896
China	4	247	19	861
France	-	-	20	643
Brazil	8	485	10	585

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1329**	**786755**	**1451**	**925819**
Russia	653	309704	747	475349
China	29	12956	219	133952
UK	247	133905	126	80647
Belgium	60	27753	100	67183
Netherlands	293	126282	86	51453
Germany	3	29647	5	45249
France	-	-	20	17149
Latvia	-	-	24	14198
Hong Kong	-	-	43	9614
USA	38	138589	2	9568
Other countries	6	7919	79	21457

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1163**	**650313**	**1263**	**805215**
Russia	593	282628	747	475349
China	9	4062	193	116724
Belgium	60	27753	100	67183
U K	182	82481	91	57395
Netherlands	282	123540	86	51453
France	-	-	20	17149
Latvia	-	-	24	14198
U S A	31	123694	2	5231
Germany	++	457	++	446
Singapore	++	76	++	77
Other countries	6	5622	++	10

Figures rounded off

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**166**	**135470**	**86**	**94590**
Germany	3	29041	5	41774
U K	65	51424	35	23243
China	20	8894	26	17187
Korea	++	235	20	4492
U S A	7	14874	++	3829
Japan	++	306	++	3562
Sweden	++	349	++	454
Thailand	-	-	++	49
Russia	60	27076	-	-
Netherlands	11	2742	-	-
Other countries	++	529	-	-

Figures rounded off

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

Country Name	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	++	**972**	**102**	**26014**
Hong Kong	-	-	**43**	9614
Mexico	-	-	**39**	8414
Japan	-	-	**20**	4399
Germany	++	149	++	3029
U S A	++	21	++	508
China	-	-	++	41
U K	-	-	++	9
Austria	++	800	-	-
Singapore	++	2	-	-

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.