Indian Minerals Yearbook 2015

(Part- III : Mineral Reviews)

54th Edition

CHROMITE

(FINAL RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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July, 2017

9 Chromite

Chromite (Cr) is the single commercially viable ore of chromium which is chemically known as iron chromium oxide (Fe Cr_2O_4). The properties of chromium that makes it most versatile and indespensable are its resistance to corrosion, oxidation, wear and 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 ferro-chrome 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 a high polish, resists tarnishing and has a high melting point.

RESOURCES

As per UNFC system, the total resources of chromite in the country as on 1.4.2013 were estimated at 322 million tonnes with 107 million tonnes as Reserves (33%) and 215 million tonnes as Remaining Resources (67%). More than 95% 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 (21%), ferro-chrome grade (17%), and refractory grade 4%. Low, Others, Unclassified and Not-known grades together account for 27% (Table- 1).

EXPLORATION & DEVELOPMENT

GSI carried out exploration for chromite in Khammam district of Telangana, Dhenkanal district of Odisha and Phek district of Nagaland. The details of exploration activities are given in Table- 2.

PRODUCTION, STOCKS & PRICES

The production of chromite was 2,164 thousand tonnes during 2014-15 which decreased by 25% as compared to that in the previous year mainly due to suspension of mining operation in certain mines in Odisha in compliance with the Statutory orders.

The number of reporting mines was 25 in 2014-15 as compared to 26 in the preceding year. Six principal producers operating 18 mines together accounted for 95% of the total production during the year. The contribution of 5 mines, each producing more than one lakh tonnes per annum was 79% of the total production.

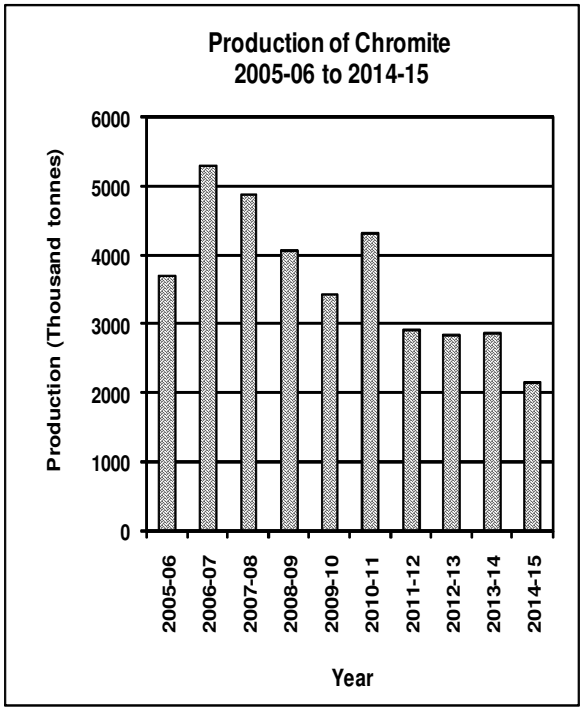

Table – 1 : Reserves/Resources of Chromite as on 1.4.2013
(By Grades/States)

(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	**56890**	**14045**	**36286**	**107221**	**28011**	**20172**	**36807**	**21249**	**32993**	**53376**	**21922**	**214530**	**321751**
By Grades													
Refractory	4161	3463	610	8234	-	775	167	15	361	2861	-	4179	12413
Charge chrome	17977	1260	4365	23602	19937	9089	2960	10266	25863	9453	7	77575	101177
Low	26	27	-	52	-	-	-	-	-	3713	-	3713	3765
Beneficiable	11671	4160	11381	27213	3647	5969	12748	3476	3704	11953	-	41497	68711
Ferro chrome	8967	3355	7569	19891	1097	1984	17888	7483	1256	4933	10	34652	54543
Others	518	-	-	518	-	432	-	-	15	-	-	447	965
Unclassified	13571	1780	12361	27712	3330	1922	3043	9	1778	20301	21359	51741	79452
Not-known	-	-	-	-	-	1	1	-	16	161	546	725	725
By States													
Andhra Pradesh	-	-	-	-	-	-	-	-	-	0.4	-	0.4	0.4
Jharkhand	-	-	-	-	-	-	-	15	98	623	-	736	736
Karnataka	328	408	12	748	270	242	96	-	20	301	-	928	1676
Maharashtra	-	-	-	-	58	23	-	43	67	441	-	632	632
Manipur	3	21	52	76	-	-	-	-	529	6052	-	6581	6657
Nagaland	-	-	-	-	-	-	-	-	-	3200	-	3200	3200
Odisha	56559	13615	36222	106397	27683	19907	36711	21184	32265	42313	21922	201985	308381
Tamil Nadu	-	-	-	-	-	-	-	7	-	276	-	282	282
Telangana	-	-	-	-	-	-	-	-	15	171	-	186	186

Figures rounded off.

Table – 2 : Details of Exploration Activities for Chromite, 2014-15

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI							
Telangana							
Khammam	Chimalapahad Ultramafic Complex	-	-	-	-	-	LSM has been carried out with a two fold objective to carry out investigation for chromite & PGE along with other mineralisation in the periphery of the Chimalapahad Ultramafic Complex near Burdharaghavpuram, Chimalapahad, Rangapuram, Ramanapalem areas. The chromite occurs as podiform lenses within the ultramafic units viz. dunite, pyroxenite, websterite and talc-tremolite schist. The thickness of layering ranges from few mm to 2-3 cm. Few discontinuous lenses of pyroxenite having dimension 4-5 m in length and 1-2 m width have also been noticed around Vinobanagar, Himamnagar and Rangapuram villages. The fine to medium grained pyroxenite is blackish green in colour. The EPMA analysis of chromite shows Cr_2O_3 from 50.32 to 51.84%, FeO ranges from 29.66 to 30.99%, Al_2O_3 from 14.23 to 15.05 and MgO ranges from 2.52 to 10.21%. As per data received so far from chemical laboratory, the layered and massive anorthosites from the ultramafic complex shows Cr % values ranging from 100 - 3807 ppm with 10 - 389 ppm copper & 10 - 1540 ppm nickel while float chromite ore from the quarry shows 41.09% of Cr.
Odisha							
Dhenkanal	North Bhuasuniparbat Block	-	-	-	-	-	G-4 stage investigation was carried with an objective to evaluate possible occurrences of chromite bodies by test drilling. A number of discontinuously occurring ultramafic bands occur from Chander to Tangeria-Bhuasuniparbat-Tulasipasi. It was represented by silicified serpentinite, altered peridotite, pyroxenite, gabbroic anorthosite, magnetite & gabbro, etc. Chromite is found to be associated with serpentinite and silicified serpentinite in the form of dissemination, stringers, veins and thin bands.The ultramafic bands extending for 250 m strike length in the eastern part and 200 m strike length in the central part of the block with disseminations of chromite have been identified. A 1.40 m thick chromite band (23.03% Cr_2O_3) was also intersected in borehole no. BBH-3 at depth from 52.95 - 54.35 m. Investigation has been completed.

(Contd.)

Table : 2 (Concld.)

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI							
Nagaland							
Phek	Waziho, Ziphu, Moki, Satuza, Phor, Sutsu, Laluri, Washelo villages.	-	-	-	-	36	G-4 investigation for chromium & associated base metals was taken up in the 'Ophiolite belt' in and arorund 8 villages in Phek district. The lithounits are peridotite, gabbro, basalt, chert and limestone. The general trend of lithounits is N-S direction. Surface indications for sulphide mineralisation are recorded in Moki village. The exploration will continue in 2015-16.

The share of Public Sector in total production was 37% in 2014-15 as compared to 24% in the previous year. About 64% of the total production was reported from captive mines in the current year as compared to 73% in the previous year.

Odisha continued to be the major chromite producing state accounting for almost the entire production during 2014-15 and nominal production was reported from Karnataka (Tables - 3 & 4).

Gradewise analysis of production during 2014-15 reveals that 52% & above Cr_2O_3 fines accounted for 37%, 40 -52% Cr_2O_3, for 31% (Lumps 4% and Fines 27%), below 40% Cr_2O_3 for 21% (Lumps 5% and Fines 16%) and chromite concentrates for 11% of the total production (Tables -5, 6 & 7).

Mine-head closing stock of chromite for the year 2014-15 was at 2,244 thousand tonnes as compared to 2,258 thousand tonnes in 2013-14 (Tables - 8A & 8B).

The average daily employment of labour in chromite mines during 2014-15 was 6,077 as against 6,277 in the previous year.

Domestic prices of chromite are furnished in the General Review on 'Prices'.

Table – 3 : Principal Producers of Chromite 2014-15

Name & address of producer	Location of mine	
	State	District
The Orissa Mining Corporation Ltd, 'OMC House', Unit 5, Post Box No. 34, Bhubaneshwar – 751 001, Odisha.	Odisha	Jajpur
Indian Metals & Ferro Alloys Ltd, IMFA Building, Bomikhal, Rasulgarh, Bhubaneshwar – 751 010, Odisha.	Odisha	Jajpur Kendujhar
Balasore Alloys Ltd, Balgopalpur, Balasore - 756 020, Odisha.	Odisha	Jajpur
Ferro Alloys Corporation Ltd, Laxmi Bhawan, Kuans, Bhadrak – 756 100, Odisha.	Odisha	Jajpur
The Tata Steel Ltd, Bombay House, 24, Homi Mody Street, Fort, Mumbai – 400 001, Maharashtra.	Odisha	Jajpur
Jindal Strips Ltd, Kalinga Nagar, Industrial Complex, Jajpur Road - 755 026, Dist: Jajpur Odisha.	Odisha	Jajpur

Table – 4 : Production of Chromite, 2012-13 to 2014-15
(By States)

(Qty in tonnes; Value in ₹'000)

State	2012-13		2013-14		2014-15 (P)	
	Qty	Value	Qty	Value	Qty	Value
India	**2833895**	**22627633**	**2878320**	**23759458**	**2163942**	**18185545**
Karnataka	6828	28720	1003	4074	2474	10049
Maharashtra	-	-	19	75	-	-
Odisha	2827067	22598913	2877298	23755309	2161468	18175496

Table – 5 : Gradewise Production of Chromite, 2013-14
(By Sectors, States and Districts)

(Qty in tonnes; Value in ₹'000)

Production by Grades : Cr_2O_3 Content

State/ District	No. of mines	Below 40%		40-52%		52% & Above		Concentrates	Total	
		Lumps	Fines	Lumps	Fines	Lumps	Fines		Quantity	Value
India	**26**	**166859**	**471713**	**90938**	**821706**	**68**	**630142**	**696894**	**2878320**	**23759458**
Public sector	11	3366	88302	-	279697	68	233364	87424	692221	7544718
Private sector	15	163493	383411	90938	542009	-	396778	609470	2186099	16214740
Karnataka	**4**	**1003**	**-**	**–**	_	**–**	**–**	_	**1003**	**4074**
Hassan	4	1003	-	**–**	_	**–**	**–**	_	1003	4074
Maharashtra	**1**	**19**	**-**	**-**	**-**	**-**	**-**	**-**	**19**	**75**
Bhandara	1	19	-	-	-	-	-	-	19	75
Odisha	**21**	**165837**	**471713**	**90938**	**821706**	**68**	**630142**	**696894**	**2877298**	**23755309**
Dhenkanal	2	-	-	-	-	**–**	**–**	**–**	-	-
Jajpur	15	142259	471713	57095	793498	68	630142	696894	2791669	23377343
Kendujhar	4	23578	**–**	33843	28208	**–**	**–**	**–**	85629	377966

Table – 6 : Gradewise Production of Chromite, 2014-15 (P)
(By Sectors, States and Districts)

(Qty in tonnes; Value in ₹'000)

Production by Grades : Cr_2O_3 Content

State/ District	No. of mines	Below 40%		40-52%		52% & Above		Concentrates	Total	
		Lumps	Fines	Lumps	Fines	Lumps	Fines		Quantity	Value
India	**25**	**114422**	**336227**	**92920**	**585709**	**-**	**790585**	**244079**	**2163942**	**18185545**
Public sector	11	2680	95868	-	289007	-	359176	48321	795052	9206674
Private sector	14	111742	240359	92920	296702	-	431409	195758	1368890	8978871
Karnataka	**4**	**2474**	**-**	**–**	_	**–**	**–**	_	**2474**	**10049**
Hassan	4	2474	-	**–**	_	**–**	**–**	_	2474	10049
Odisha	**21**	**111948**	**336227**	**92920**	**585709**	**-**	**790585**	**244079**	**2161468**	**18175496**
Dhenkanal	2	-	-	-	-	**–**	**–**	**–**	-	-
Jajpur	15	94543	336227	60132	560067	-	790585	244079	2085633	18016081
Kendujhar	4	17405	**–**	32788	25642	**–**	**–**	**–**	75835	159415

Table – 7 : Production of Chromite, 2013-14 and 2014-15 (By Frequency Groups)

(Qty in tonnes)

Production group	No. of mines		Production for the group		Percentage in total production		Cumulative percentage	
	2013-14	2014-15 (P)	2013-14	2014-15 (P)	2013-14	2014-15 (P)	2013-14	2014-15 (P)
Total	**26**	**25**	**2878320**	**2163942**	**100.00**	**100.00**	**-**	**-**
Up to 10000	13	13	1022	2474	0.04	0.11	0.04	0.12
100001 - 100000	7	7	453944	447754	15.77	20.69	15.81	20.81
100001 - 200000	1	1	101893	178378	3.54	8.24	19.35	29.05
200001 - 300000	2	2	485830	472828	16.88	21.85	36.23	50.90
300001 and above	3	2	1835631	1062508	63.77	49.10	100.00	100.00

Table – 8 (A) : Mine-head Closing Stocks of Chromite, 2013-14 (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	**68624**	**1613172**	**25947**	**286780**	**617**	**185281**	**77993**	**2258414**
Karnataka	15554	303	-	-	-	-	-	15857
Maharashtra	19	-	-	-	-	-	-	19
Odisha	53051	1612869	25947	286780	617	185281	77993	2242538

Table – 8 (B) : Mine-head Closing Stocks of Chromite, 2014-15 (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	**78458**	**1538529**	**15048**	**242239**	**617**	**298119**	**71355**	**2244365**
Karnataka	18162	303	-	-	-	-	-	18465
Odisha	60296	1538226	15048	242239	617	298119	71355	2225900

MINING & TRANSPORT

At present, mining operations for chromite are restricted only in the Sukinda ultramafic belt and in the Baula Nausahi chromite belt in Odisha and in Hassan district of Karnataka. The exploitation of chromite in the areas commenced from the surface by 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 is done by jack hammer and blasting with appropriate quantity of explosives to 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.

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 three chromite mines viz. , Kathpal mine of M/s FACOR, Nausahi mine of M/s IMFA and Baula mine of M/s FACOR.The Kathpal chromite mine of M/s FACOR is 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 pumped 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 ferro-chrome industries, from spray paintings, chrome baths, refractory industries and mining of chromite and magnesite. In rural areas, chromium in atmosphere rarely exceeds 1mg/cu m of air, but towns with major iron & steel industries may have 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 an increase in deaths (18.2%; $p<0.01$) from respiratory cancer among chromite workers as compared with 1.2% deaths among controls. In a follow-up study conducted when more than 50% of the cohort had dead, the observed incidence for lung cancer deaths had increased to approximately 60%.

CONSUMPTION

The consumption of chromite in the organised sector decreased by about 5% from 24,32,800 tonnes in 2013-14 to 23,13,400 tonnes in 2014-15. Almost the entire consumption (98%) was by Ferro-alloys/Charge-chrome Industry. In addition to above, chromite in substantial quanti-ties is also consumed in 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, ferrochrome & ferrochrome-silicon from 2012-13 to 2014-15 are furnished in Tables - 9 to 11.

Table – 9: Consumption* of Chromite 2012-13 to 2014-15 (By Industries)

(In tonnes)

Industry	2012-13	2013-14 (R)	2014-15 (P)
All Industries	**2603300**	**2432800**	**2313400**
Chemical[@]	106500(2)	125000[(e)#]	6800(4)
Ferro-alloys (including charge-chrome)	2454400[(e)]	2265600[(e)]	2265600[(e)]
Refractory (including iron & steel)	41700(24)	41500(25)	40300(25)
Others (foundry, ceramic, glass)	700(5)	700(6)	700(6)

Figures rounded off.Figures in parentheses denote the number of units in the organised sector.
**Paucity of data hence coverage may not be complete. Small-scale sector is also producing ferrochrome for which data is not available.*
[@] Estimates based on products like sodium dichromate of the chemical industry.

Table – 10 : Consumption* of Ferrochrome, 2012-13 to 2014-15 (By Industries)

(In tonnes)

Industry	2012-13	2013-14 (R)	2014-15 (P)
All Industries	**286900**	**286800**	**286900**
Alloy Steel	27600(12)	27600(11)	27600(11)
Electrode	200(4)	100(4)	100(4)
Foundry	300(8)	400(10)	400(10)
Iron & Steel	258800(14)	258800(14)	258800(14)

Figures rounded off.
Figures in parentheses denote the number of units in the organised sector.
** Paucity of data hence coverage may not be complete.*

Table – 11 : Consumption* of Ferro-chrome-silicon, 2012-13 to 2014-15 (By Industries)

(In tonnes)

Industry	2012-13	2013-14 (R)	2014-15 (P)
All Industries	**460**	**460**	**460**
Alloy Steel	460(1)	460(1)	460(1)

Figures rounded off.
Figures in parentheses denote the number of units in the organised sector.
** Paucity of data, hence coverage may not be complete.*

USES

In metallurgy, chromite is mainly used in the manufacture of ferrochrome, silico-chrome, 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) and these are used for cutlery and cooking utensils and in aircraft and high-speed trains, respectively. Chromium (17%) 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.

It's melting point and ability to withstand sudden temperature changes and its chemically neutral character, moderate thermal expansion and mechanical strength.

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 IS specifications for metallurgical, refractory, chemical and foundry industries are detailed in Tables -12 to 15.

Table – 12 : IS Specifications of Chromite for Metallurgical Industry (IS : 10818-1984) (Reaffirmed in Jan. 2014)

Sl No.	Characteristic (on dry basis)	Grade (%)			
		Low carbon ferrochrome	High carbon ferrochrome	Silico-chrome	Charge-chrome
1.	Cr_2O_3 percent, min.	48	48	48	44
2.	Total iron percent, max. (as FeO)	15	16	15	18
3.	Al_2O_3 percent	13	13	13	10
4.	SiO_2 percent, max.	5	8	10	12
5.	CaO percent, max.	5	5	5	5
6.	MgO percent, max.	14	16	14	12
7.	Sulphur* (as SO_3) percent, max.	0.1	0.1	0.1	0.14
8.	Phosphorus* (as P_2O_5) percent, max.	0.005	0.02	0.02	0.2
9.	Cr:Fe, min.	3:1	2.8:1	3:1	1.6:2
10.	MgO:Al_2O_3 (range)	–	1.2-1:4	–	–

* *Sulphur* (as SO_3) *and phosphorus* (as P_2O_5) *may be determined as agreed upon by the supplier and the purchaser.*

Table – 13 : IS Specifications of Chromite for Refractory Industry
(IS : 10819-1999)
(First Revision Oct. 2011)

a) Chemical

Sl No.	Characteristic (on dry basis)	Grade - I (percent by mass)	Grade - II (percent by mass)	Grade - III (percent by mass)
1.	Loss on ignition	1.5 max.	1.5 max.	1.5 max.
2.	Cr_2O_3	52 min.	50 min.	48 min.
3.	Total iron (as FeO)	16 max.	18 max.	18 max.
4.	SiO_2	3 max.	7 max.	9 max.
5.	MgO	15 max.	15 max.	15 max.

b) Physical

All the refractory grades of chromite are hard, massive, fine-grained, serpentine-free lumpy ores and in the size range -50 mm to + 50 mm.

Table - 14: IS Specifications of Chromite for Chemical Industry
(IS : 4737-1982) (First Revision, Reaffirmed 2011)

Sl No.	Characteristic (on dry basis)	Requirement (%)
1.	Chromic oxide (as Cr_2O_3), percent by mass, min.	44.0
2.	Total iron (as FeO), percent by mass, max.	20.0
3.	Alumina (as Al_2O_3), percent by mass, max.	14.0
4.	Silica (as SiO_2), percent by mass, max.	7.0
5.	Lime (as CaO), percent by mass, max.	3.0
6.	Magnesia (MgO), percent by mass, max.	14.0

Table – 15 : IS Specifications of Chromite Sand for Foundries
(IS : 6788-1973) (Reaffirmed Feb. 2014)

a) Chemical

Sl No.	Constituent (on dry basis)	Requirement (%)
1.	Cr_2O_3	44 min.
2.	Fe_2O_3	26 max.
3.	SiO_2	4 max.
4.	CaO	0.5 max.
5.	MgO	As agreed
6.	Clay	0.75 max.
7.	LOI	1.0 max.
8.	Moisture	0.5 max.
9.	pH value	Between 7.0 and 9.0

b) Physical

The material shall be of two grades, namely, fine and coarse. The shape of grains should be mostly sub-angular and the fusion point should not be below 1800^0C. The fineness of the two grades of chromite sand shall conform to the following requirement:

I.S. Sieve	Fraction Retained on	
	Fine Grade (F) (%)	Coarse Grade (C) (%)
710 micron	–	5 max.
500 micron	–	10 max.
355 micron	–	10-25
250 micron	3 max.	10-25
212 micron	18 max.	10-20
150 micron	70 min.	10-20
106 micron		7-20
75 micron		12 max.
Pan	12 max.	6 max.

INDUSTRY

Chromite is mainly used in Metallurgical Industry for manufacture of ferro-alloys, e.g., ferrochrome, charge-chrome and silico-chrome 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) and these 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 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; Utkal Manufacturing Services Ltd, Choudhwar, 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.

Tata Steel Ltd, FACOR and Indian Metals & Ferro Alloys Ltd, (IMFA) the three major producers of charge-chrome in the country are 100% export-oriented, having a total capacity of 182,500 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 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 discoloration 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) currently comprises the major commercial use for the element,with applications for production of chromium compounds constituting a minor share.

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-16.

Table – 16 : 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.	NA
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,	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%,
Tawi Chemicals Industries Distt. Samba.	NA
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 36% ; Friable : Cr_2O_3 40% ; 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.	Cr_2O_3 : 40-48% SiO_2 : 15% max.

(Contd.)

Table - 16 (Concld.)

Industry/Name and location of plant	Specifications of ore consumed
Indian Metals & Ferro Alloys Ltd, Therubali, Distt. Raygada.	Lumps & fines
Rohit Ferro Tech. Ltd, (Unit 2) Duburi, Distt. Jajpur.	Lumps, fines & concentrates
Tata Steel Ltd, (Formerly OMC Alloys Ltd) Bamnipal, Distt. Keonjhar.	Cr_2O_3 : 47% min. Size : 0-40 mm
West Bengal	
Rohit Ferro Tech Ltd, (Unit 1) Bishnupur, Distt. Bankura.	Lumps, fines & concentrates
Shri Vasavi Industries Ltd, Distt. Bankura.	NA
REFRACTORY	
Chhattisgarh	
SAIL Refractories Unit, Marauda, Distt. Durg.	Friable lumps : Cr_2O_3 : 52-54% 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 : 52-54% Fe_2O_3 : 15-18% max. SiO_2 : 3-5%
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. Jharsuguda.	Cr_2O_3 : 48-50% min.
Shree Chem Industries (Pvt) Ltd, Mandiyakudar, Distt. Sundargarh.	Cr_2O_3 : 54% SiO_2 : 5-9% min.
Khemka Refractories Pvt. Ltd, Kamakhyanagar - 759 018, Distt. Dhenkanal.	Cr_2O_3 : 52% min., Fines
Larsen & Toubro Ltd, Kansbahal - 770 034, Distt. Sundargarh.	N. A.
Tamil Nadu	
Burn Standard Co. Ltd, Salem.	Cr_2O_3 : 52-54% min. SiO_2 : 3-5% max. Fe_2O_3 : 15-18% 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 : 48-55%

TRADE POLICY

The Ministry of Commerce and Industry, Department of Commerce had come out with the new Foreign Trade Policy (FTP) for the period 2009-2014. As per the present Export-Import Policy as amended and effectuated from 5.6.2012, the imports of chromium ore lumps, friable ores and concentrates are freely allowed. There is no change in FTP for the period 2015-16. 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 resources of shipping-grade chromite are more than 12 billion tonnes in terms of chromium metal content. Countries that possess sizeable quantities of resources are Kazakhstan (47%), South Africa (41%) and India (11%). These two countries concentrated about 90% of world's 480 million tonnes chromium. The available data on world reserves of chromite (shipping grade) is shown in Table-17.

Table – 17 : World Reserves of Chromite (Shipping Grade) (By Principal Countries)

(In '000 tonnes of chromium content)

Country	Reserves
World: Total (rounded)	**>4,80,000**
India*	54,000
Kazakhstan	2,30,000
South Africa	2,00,000
USA	620
Other Countries	NA

(>) : More than
Source: *Mineral Commodity Summaries, 2016.*
****:*** *As per UNFC System, India's total resources are estimated at 322 million tonnes as on 1.4.2013. Shipping grade - Deposit quantity and grade normalised to 45% Cr_2O_3.*

South Africa is by far the largest producer of chromite ore and concentrates followed by Kazakhstan, Turkey and India. Russia, Oman Brazil and Pakistan are other important producers. In Europe, Finland and Albania are the major producing countries.

The world production of chromite decreased marginally to 30 million tonnes in 2014 as compared to 31 million tonnes during the previous year. South Africa was the leading producer, contributing about 47% to the total world production, followed by Kazakhstan (18%), Turkey (14%) and India (6%). Other significant producers were Finland, Oman, Albania and Brazil (Table- 18).

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.

Table – 18 : World Production of Chromium Ores and Concentrates (By Principal Countries)

(In '000 tonnes)

Country	2012	2013	2014
World: Total	**27209**	**30957**	**30017**
Albania	366	530	679
Australia	452	355	-
Brazil	473	486	456
China[(e)]	220	220	220
Finland	425	982	1035
India*	2834	2853	1681
Iran	412	344	350[e]
Kazakhstan	5233	5255	5411
Oman	555	788	751
Pakistan[e]	500	490	350
Russia	552	360	360[e]
South Africa	11310	13645	14038
Turkey	3295	4141	4100[e]
Zimbabwe	408	355	408
Other countries	174	154	178

Source: *World Mineral Production, 2010-14.*
** Production of chromite in India in 2012-13, 2013-14 and 2014-15 was 2.83 million tonnes, 2.88 million tonnes and 2.16 million tonnes, respectively.*

Albania

Albanian Nickel & Chrome sh.p.k. (ANC), formerly Metals Finance Albania sh.p.k. reported that Albanian chromite ore reserves were 12.8 Mt with an average grade of 30% Cr_2O_3 and a chromium to iron ratio of 3 : 1.

Australia

Consolidated Minerals Ltd, Australia's sole producer of chromite ore in the form of lump and sands for use in the production of ferro-chromium, has stopped production of its sole Coobina mine in July 2013 and tenements were transferred to Mineral Resources Ltd.

China

China was the leading ferro-chromium producer. Sinosteel Corp reported that it is a key world ferro-chromium producer, with ownership interest in four plants. Sinosteel held 60% of ASA Metals (Pty.) Ltd (South Africa), 50% of Tubatse Chrome Minerals (Pty.) Ltd (South Africa), 67% of Zimasco Consolidated Enterprises (Zimbabwe) and Sinosteel Jilin Ferroalloys Co. Ltd. Through these holdings, Sinosteel Production capacity was 1.2 Mt/yr of ferro-chromium.

Finland

Finland was the sole producer of chromite ore in the European Union. Tasman Metals Ltd acquired the Akanvaara and Koitelainen chromite projects in northeastern Finland. .

Kazakhstan

Kazakhstan hosts the world's largest reserves of chromite, the majority of which are located in the Kempirsai Massif district, in the west of the country. Kazakhstan was the second largest producer of chromite and leading producer of ferro-chromium in 2014. Ferro-alloys division of Eurasian Natural Resources Corp.(ENRC) is the leading producer of chromite ore and ferro-chromium.

Oman

Al Tamman Indsil Ferrochrome LLC operated a ferro-chromium plant with two furnaces in the Sohar Freezone using Omani and imported chromite ore. Al Tamman started its first furnace in June 2013; its second furnace did not start producing until January, 2014 owing to a shortage of chromite ore. Al Tamman has an annual ferrochromium production capacity of 75,000 tonnes. Two other ferro-chromium smelters were under construction in the Sohar Freezone: Metkore Alloys & Industries of India with a capacity of 165,000 tonne per year and Gulf Mining Group with a capacity of 50,000 tonnes per year.

Russia

Novotroitsk Plant of chromium compounds OJSC (NPCC) has produced chromium chemicals since 1963, aluminothermically produced chromium metal since 2000 with an annual capacity of 9,000 tonnes, and low carbon ferro-chromium. NPCC planned to start production of degassed, electrolytically produced chromium metal in 2015, making it the second such producer after Polema JSC, in Tula.

South Africa

South Africa was the leading chromite ore producer and a leading ferro-chromium producer. In support of the Department of Mineral Resources policy to increase the value of South African mineral exports through beneficiation, the ferro-chromium producers advocated that the state impose a tariff on exports of chromite ore; however, ferro-chromium producers stopped advocating for that tax off late.

FOREIGN TRADE

Exports

Exports of chromite decreased sharply to 25 thousand tonnes in 2014-15 from 195 thousand tonnes in the previous year. Out of total chromite exported in 2014-15, the share of about 35% was of chromite concentrate, while chromite ore (others) accounted for 65%. There were no export of chrome ore lumps in 2014-15. Exports were mainly to Japan (91%) and Korea, Rep. of (6%). In 2014-15, 94 tonnes of chromium & alloys (scrap) were exported registering an increase of 29% from that of the preceding year. Exports were mainly to USA (40%) and Indonesia (21%).

The export details of ferrochrome are furnished in the Review entitled, 'Ferro-alloys' (Tables-19 to 26).

Table – 19 : Exports of Chromite : Total (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**195125**	**3468440**	**25361**	**659259**
Japan	17174	406239	23036	484952
Korea, Rep. of	-	-	1422	147861
Spain	2276	60768	340	10014
Vietnam	192	6448	240	7959
China	175460	2994231	280	7084
Hong Kong	-	-	17	574
Colombia	-	-	12	485
UAE	-	-	7	182
South Africa	-	-	7	149
Other countries	23	754	-	-

Table – 20 : Exports of Chrome Ore Lumps (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**77**	**2205**	**-**	**-**
Finland	1	14	-	-
Spain	76	2191	-	-

Table – 21 : Exports of Chrome Ore Concentrates (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**35281**	**624930**	**8997**	**330707**
Japan	-	-	6938	165174
Korea, Rep. of	-	-	1422	147861
Spain	2200	58577	340	10014
China	33081	566353	280	7084
Hong Kong	-	-	17	574

Table – 22 : Exports of Chrome Ore (Others) (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**159767**	**2841305**	**16364**	**328552**
Japan	17174	406239	16098	319777
Vietnam	192	6448	240	7959
Colombia	-	-	12	485
UAE	-	-	7	182
South Africa	-	-	7	149
Other countries	142401	2428618	-	-

Table – 23 : Exports of Chromium & Alloys (Scrap) (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**73**	**77559**	**94**	**72047**
USA	-	-	38	24909
Indonesia	5	3792	20	14735
Peru	15	13503	10	9889
Malaysia	13	16929	13	9135
Italy	30	32503	5	5496
Brazil	7	7193	2	2312
France	-	-	++	1676
Ireland	++	680	2	1607
Saudi Arabia	-	-	1	780
Turkey	++	367	1	593
Other countries	3	2592	2	915

Table – 24 : Exports of Chromium Articles, Nes (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**4**	**10601**	**++**	**1676**
France	-	-	++	1676
Other countries	4	10601	-	-

Table – 25 : Exports of Chromium & Scrap (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**++**	**6**	**1**	**782**
Saudi Arabia	-	-	1	780
UAE	++	1	++	2
Other countries	++	5	-	-

Table – 26 : Exports of Chromium Unwrought : Powder (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**69**	**66952**	**93**	**69589**
USA	-	-	38	24909
Indonesia	5	3792	20	14735
Peru	15	13503	10	9889
Malaysia	10	7623	13	9135
Italy	30	32503	5	5496
Brazil	7	7193	2	2312
Ireland	++	680	2	1607
Turkey	++	367	1	593
Kenya	1	428	1	563
Israel	1	373	1	344
Other countries	++	490	++	6

Imports

Imports of chromite decreased marginally to 243 thousand tonnes in 2014-15 from 261 thousand tonnes in the previous year. Out of total quantity of chromite imported in 2014-15, lumpy chromite accounted for 80%, while concentrate and other forms accounted for the remaining 20%. Imports were mainly from Oman (52%) and South Africa (47%). Imports of chrome lump were mainly from Oman (64%) and South Africa (36%). Imports of chromium and alloys in 2014-15 were 1,003 tonnes as compared to 853 tonnes in the previous year. Imports were mainly from Russia (72%), UK (9%) and China (8%). Imports of chromium and scrap increased to 24 tonnes in 2014-15 from 22 tonnes in 2013-14.

The import details of ferrochrome are furnished in the Review entitled 'Ferro-alloys' (Tables-27 to 34).

Table – 27: Imports of Chromite : Total (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**261336**	**3099722**	**242685**	**2871479**
South Africa	86180	1378574	113635	1595558
Oman	169490	1652657	126825	1230040
Pakistan	1073	11123	350	12385
Albania	-	-	515	8734
Philippines	1906	29876	725	7794
UK	-	-	168	5129
Belgium	-	-	152	4358
China	-	-	204	4262
Netherlands	22	1254	109	3079
Korea, Rep. of	-	-	2	118
Other countries	2665	26238	++	22

Table – 28 : Imports of Chrome Lump (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**229166**	**2618030**	**195219**	**2157413**
Oman	157692	1536192	124197	1196625
South Africa	65977	1018148	69682	939453
Albania	-	-	515	8734
Pakistan	1048	10164	200	6947
Philippines	1906	29876	625	5654
Other countries	2543	23650	-	-

Table – 29 : Imports of Chrome Ore Concentrate (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**3564**	**88305**	**11331**	**196110**
South Africa	3545	87918	11331	196110
Other countries	19	387	-	-

Table – 30 : Imports of Chrome Ore Others (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**28606**	**393387**	**36135**	**517956**
South Africa	16658	272508	32622	459994
Oman	11798	116465	2628	33415
Pakistan	25	959	150	5439
UK	-	-	168	5129
Belgium	-	-	152	4358
China	-	-	204	4262
Netherlands	22	1254	109	3079
Philippines	-	-	100	2140
Korea, Rep. of	-	-	2	118
Chinese Taipei/Taiwan	-	-	++	13
Other countries	103	2201	++	9

Table – 31 : Imports of Chromium & Alloys (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**853**	**543400**	**1003**	**640994**
Russia	437	238714	720	392877
UK	207	125692	90	57544
China	90	48600	79	46364
Germany	18	49414	17	42613
France	30	17495	36	28931
USA	14	25832	11	24470
Singapore	1	1887	6	17168
Korea, Rep. of	++	598	20	11115
Japan	3	5646	5	9200
UAE	26	14791	6	3341
Other countries	27	14731	13	7371

Table – 32 Imports of Chromium Unwrought : Powders (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**781**	**475897**	**885**	**529153**
Russia	437	238714	700	380125
UK	196	112076	85	51015
Germany	14	34713	15	30955
China	68	35874	33	17730
USA	11	19416	10	17556
Korea, Rep. of	-	-	20	10888
Japan	3	5646	5	9020
UAE	26	14791	6	3341
Singapore	1	1433	1	3082
Korea, Dem. Rep. of	-	-	5	2768
Other countries	25	13234	5	2673

Table – 33 Imports of Chromium Articles, Nes (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**50**	**52447**	**92**	**89759**
France	30	17495	36	28931
China	2	2893	26	19703
Russia	-	-	20	12752
Germany	4	14701	2	11658
USA	1	1707	1	6724
UK	11	13610	5	5548
Singapore	-	-	1	2287
Austria	-	-	1	1253
Australia	-	-	++	351
Liechtenstein	++	317	++	325
Other countries	2	1724	++	227

Table – 34 : Imports of Chromium & Scrap (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**22**	**15056**	**24**	**22082**
Singapore	++	454	4	11799
China	20	9834	20	8932
UK	++	6	++	981
USA	2	4709	++	189
Japan	-	-	++	181
Other countries	++	53	-	-

FUTURE OUTLOOK

The Report of the Working Group for 12th Plan Period, Planning Commission, now, Niti Aayog, has estimated chromite production at about 7.37 million tonnes by 2016-17 at 8% growth rate. The apparent consumption is estimated at 4.35 million tonnes by 2016-17 at 8% growth rate. The Working Group had also made following recommendations: (i) Chromite resources are located to the extent of 90% in Odisha, predominantly in Sukinda Valley. The mines are going deeper and ore is becoming friable at lower levels. Exploration of deep-seated ore bodies needs to be carried out on an urgent basis. (ii) Exploration efforts also need to be intensified to identify more deposits of chromite in the country. Underground mining technology needs to be promoted. (iii) Suitable technology needs to be developed for beneficiation of low-grade, friable chromite ore (30% Cr_2O_3) fines which are available in sizeable quantity in India. (iv) Further restrictions on exports of chromite ore/ concentrates are desirable in view of the limited resources in India and the increasing demand of the Steel Industry. (v) R & D is required for development of suitable technology for extraction of Nickel from the Chromite overburden from the Sukinda area of Odisha.

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 $Cr.^{+VI.}$

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 recommendation putforth the need for detailed exploration of chromite in all the potential areas in Odisha, Karnataka and ophiolite belt of North-Eastern region with a view to prognosticate resources to a depth of 500 m in Sukinda belt and estimation of resources in all other potential areas. Addressing concerns in ferrochrome production which is electrical 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 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.