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CHROMITE

(FINAL RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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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 & 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 a high polish, resists tarnishing and has a high melting point.

RESERVES/RESOURCES

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

EXPLORATION & DEVELOPMENT

GSI has has carried out exploration for chromite in Nagaland during the year 2015-16, which is given in Table-2. Exploration activities carried out by State Governments of Odisha and Karnataka is not available.

PRODUCTION AND STOCKS

The production of chromite was 2,894 thousand tonnes during 2015-16 which increased by 34% as compared to that in the previous year.

The number of reporting mines were 24 in 2015-16 as compared to 26 in the preceding year. Five principal producers operating 17 mines together accounted for 90% of the total production during the year. The contribution of 6 mines, each producing more than one lakh tonne per annum was 86% of the total production.

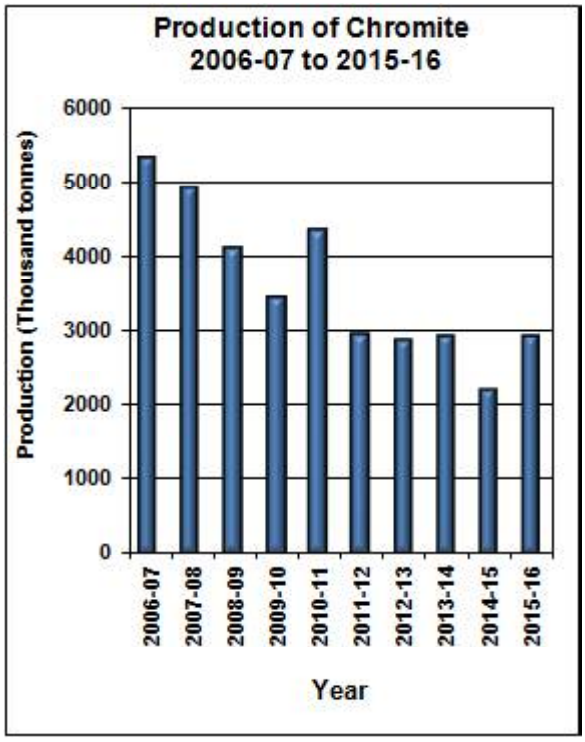

Table – 1 : Reserves/Resources of Chromite as on 1.4.2015
(By Grades/States)

(In '000 tonnes)

Grade/State	Reserves				Remaining Resources								Total Resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD 221	STD 222						
All India : Total	**64465**	**12815**	**24930**	**102210**	**67618**	**15780**	**33506**	**26914**	**33076**	**44458**	**20452**	**241806**	**344016**
By Grades													
Refractory	26759	2803	416	29978	9234	987	320	3635	550	2958	-	17684	47662
Charge chrome	16476	-	9328	25804	25726	8333	4048	8931	25000	7861	7	79905	105709
Low	-	-	-	-	26	27	-	-	-	3713	-	3765	3765
Beneficiable	12528	10012	9018	31557	17992	2272	10649	6856	6069	10301	-	54139	85697
Ferrochrome	7809	-	6033	13842	14043	2004	17888	7483	1134	4942	10	47504	61346
Others	133	-	-	133	348	377	-	-	15	-	-	740	873
Unclassified	761	-	135	896	250	1780	602	9	308	14506	19889	37343	38239
Not-known	-	-	-	-	-	1	1	-	-	177	546	725	725
By States													
Andhra Pradesh	-	-	-	-	-	-	-	-	-	-	-	-	-
Jharkhand	-	-	-	-	-	-	-	15	98	623	-	736	736
Karnataka	315	340	72	727	300	230	96	-	20	259	-	905	1631
Maharashtra	-	48	23	71	5	-	5	43	67	418	-	538	609
Manipur	-	-	-	-	3	21	52	-	504	6077	-	6657	6657
Nagaland	-	-	-	-	-	-	-	-	-	3200	-	3200	3200
Odisha	64150	12427	24835	101412	67311	15529	33354	26850	32372	33434	20452	229301	330714
Tamil Nadu	-	-	-	-	-	-	-	7	-	276	-	282	282
Telangana	-	-	-	-	-	-	-	-	15	171	-	186	186

Figures rounded off.

Table – 2 : Details of Exploration Activities for Chromite, 2015-16

Agency/ State/District	Location/ Area/ Block	Mapping Scale	Mapping Area (Sq km)	Drilling No. of boreholes	Drilling Meterage	Sampling (No.)	Remarks Reserves/Resources estimated
GSI							
Nagaland							
Phek	Ziphu area	N.A.	50	Nil	Nil	N.A.	G-4 stage investigation for chromium & associated base metals around Ziphu was taken up in the 'Ophiolite belt'. No surface indication of presence of chromite and associated sulphide mineralisation has been recorded in the mapped area. In the WNW of Washelo, chromite pods varying in size from 10-30 cm are scattered along the slope of peridotite hill; however, no in situ chromite pod has been observed. A thick limonitised zone hosted within chert is exposed in and around Ziphu and have not yielded any encouraging results for base metal mineralisation.

The share of Public Sector in total production was 37% in 2015-16 as well as in the previous year. About 33% of the total production was reported from captive mines in the current year as compared to 39% in the previous year.

Odisha continued to be the major chromite producing state accounting for almost the entire production during 2015-16 and nominal production was reported from Karnataka and Maharashtra (Tables - 3 & 4).

Gradewise analysis of production during 2015-16 reveals that 52% & above Cr_2O_3 fines accounted for 27%, 40 -52% Cr_2O_3 for 38% (Lumps 2% and Fines 36%), below 40% Cr_2O_3 for 22% (Lumps 4% and Fines 18%) and chromite concentrates for 13% of the total production (Tables-5, 6 & 7).

Mine-head closing stock of chromite for the year 2015-16 was at 2,532 thousand tonnes as compared to 2,245 thousand tonnes in 2014-15 (Tables- 8A & 8B).

The average daily employment of labour in chromite mines during 2015-16 was 6,416 as against 6,772 in the previous year.

Table – 3 : Principal Producers of Chromite 2015-16

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
The Tata Steel Ltd, Bombay House, 24, Homi Mody Street, Fort, Mumbai – 400 001, Maharashtra.	Odisha	Jajpur
Balasore Alloys Ltd, Balgopalpur, P.O. Rasalpur, Balasore - 756 020, Odisha.	Odisha	Jajpur
Indian Metals & Ferro Alloys Ltd, IMFA Building, Bomikhal, Rasulgarh, Bhubaneshwar – 751 010, Odisha.	Odisha	Jajpur Kendujhar
Ferro Alloys Corporation Ltd, Laxmi Bhawan, Kuans, Bhadrak – 756 100, Odisha.	Odisha	Jajpur

Table – 4 : Production of Chromite, 2013-14 to 2015-16
(By States)

(Qty in tonnes; Value in `'000)

State	2013-14		2014-15		2015-16 (P)	
	Qty	Value	Qty	Value	Qty	Value
India	**2878320**	**23759458**	**2164163**	**18800279**	**2893997**	**23047531**
Karnataka	1003	4074	2674	16044	1808	9593
Maharashtra	19	75	26	79	90	390
Odisha	2877298	23755309	2161463	18784156	2892099	23037548

Table – 5 : Gradewise Production of Chromite, 2014-15
(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**	**114648**	**336223**	**92919**	**585708**	**-**	**790585**	**244080**	**2164163**	**18800279**
Public sector	11	2880	95868	-	289004	-	359176	48322	795250	9327701
Private sector	15	111768	240355	92919	296704	-	431409	195758	1368913	9472578
Karnataka	**4**	**2674**	**-**	**-**	**-**	**-**	**-**	**-**	**2674**	**16044**
Hassan	4	2674	-	-	-	-	-	-	2674	16044
Maharashtra	**1**	**26**	**-**	**-**	**-**	**-**	**-**	**-**	**26**	**79**
Bhandara	1	26	-	-	-	-	-	-	26	79
Odisha	**21**	**111948**	**336223**	**92919**	**585708**	**-**	**790585**	**244080**	**2161463**	**18784156**
Dhenkanal	2*	-	-	-	-	-	-	-	-	-
Jajpur	15	94543	336223	60131	560066	-	790585	244080	2085628	18472323
Kendujhar	4	17405	-	32788	25642	-	-	-	75835	311833

*Only labour reported

Table – 6 : Gradewise Production of Chromite, 2015-16 (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	**24**	**111168**	**523892**	**52456**	**1057598**	**-**	**782096**	**366787**	**2893997**	**23047531**
Public sector	10	2636	173420	-	512551	-	346596	41321	1076524	9390519
Private sector	14	108532	350472	52456	545047	-	435500	325466	1817473	13657012
Karnataka	**3**	**1808**	**-**	**-**	**-**	**-**	**-**	**-**	**1808**	**9593**
Hassan	3	1808	-	-	-	-	-	-	1808	9593
Maharashtra	**1**	**90**	**-**	**-**	**-**	**-**	**-**	**-**	**90**	**390**
Bhandara	1	90	-	-	-	-	-	-	90	390
Odisha	**20**	**109270**	**523892**	**52456**	**1057598**	**-**	**782096**	**366787**	**2892099**	**23037548**
Dhenkanal	2	-	-	-	-	-	-	-	-	-
Jajpur	14	109270	523892	52456	1057598	-	782096	366787	2892099	23037548
Kendujhar	4	-	-	-	-	-	-	-	-	-

Table – 7 : Production of Chromite, 2014-15 and 2015-16 (By Frequency Groups)

(Qty in tonnes)

Production group	No. of mines		Production for the group		Percentage in total production		Cumulative percentage	
	2014-15	2015-16 (P)	2014-15	2015-16 (P)	2014-15	2015-16 (P)	2014-15	2015-16 (P)
Total	**26**	**24**	**2164163**	**2893997**	**100.00**	**100.00**	-	-
Up to 10000	14	12	2700	1898	0.12	0.07	0.12	0.07
10001- 100000	7	6	447752	412017	20.69	14.24	20.81	14.31
100001 - 200000	1	2	178378	239099	8.24	8.26	29.05	22.57
200001 - 300000	2	1	472827	273597	21.85	9.45	50.90	32.02
300001 and above	2	3	1062506	1967386	49.10	67.98	100.00	100.00

Table – 8 (A) : Mine-head Closing Stocks of Chromite, 2014-15 (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	**78452**	**1538528**	**15239**	**242236**	**617**	**298116**	**71359**	**2244547**
Karnataka	18162	303	-	-	-	-	-	18465
Maharashtra	183	-	-	-	-	-	-	183
Odisha	60107	1538225	15239	242236	617	298116	71359	2225899

Table – 8 (B) : Mine-head Closing Stocks of Chromite, 2015-16 (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	**43792**	**1672473**	**11135**	**398710**	**617**	**249499**	**155602**	**2531828**
Karnataka	20212	-	-	-	-	4	-	20216
Maharashtra	189	-	-	-	-	-	-	189
Odisha	23391	1672473	11135	398710	617	249495	155602	2511423

MINING & TRANSPORT

At present, mining operations for chromite are restricted in the Sukinda ultramafic belt, in the Baula Nausahi chromite belt in Odisha, in Hassan district of Karnataka and minor quantity is also produced in Maharashtra. The 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.

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

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

ENVIRONMENTAL PROBLEMS

The major problems associated with chromite mining are the pollution and degradation caused to the environment. The hexavalent chromium, especially in friable ore is the major cause of concern as it is carcinogenic in nature. The hexavalent chromium contamination of water bodies is a major issue that requires concerted attention.Viable treatment methods of 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 increased by about 6% from 20,58,200 tonnes in 2014-15 to 21,91,500 tonnes in 2015-16. Almost the entire consumption (97%) was by Ferroalloys/Charge-chrome Industry. In

addition to above, chromite in substantial quantities 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 2013-14 to 2015-16 are furnished in Tables - 9 to 11.

Table – 9: Consumption* of Chromite 2013-14 to 2015-16 (By Industries)

(In tonnes)

Industry	2013-14	2014-15 (R)	2015-16 (P)
All Industries	**2432800**	**2058200**	**2191500**
Chemical	125000(e)#	7800	9700
Concentrates (Chrome ore/ chromite)	Nil	33600	43000
Ferroalloys (including charge-chrome)	2265600	1996100	2118000
Refractory (including iron & steel)	41500	20000	20100
Others (foundry, ceramic, glass)	700	700	700

Figures rounded off.

** Includes actual reported consumption and/or estimates made wherever required and paucity of data, hence coverage may not be completed.*
Small- scale sector is also producing ferrochrome for which data is not available.
 # Based on BDP report, 2013.

Table – 10 : Consumption* of Ferro chrome, 2013-14 to 2015-16 (By Industries)

(In tonnes)

Industry	2013-14	2014-15(R)	2015-16 (P)
All Industries	**286900**	**275600**	**290300**
Alloy Steel	27600	16300	20900
Electrode	100	100	200
Foundry	400	400	400
Iron & Steel	258800	258800	258800

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

Table – 11 : Consumption* of Ferrochrome-silicon, 2013-14 to 2015-16 (By Industries)

(In tonnes)

Industry	2013-14	2014-15(R)	2015-16 (P)
All Industries	**460**	**460**	**460**
Alloy Steel	460	460	460

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

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. Ferro chrome 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 & 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 – 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 – 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 - 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 ^{0}C .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 ferroalloys, e.g., ferrochrome, charge-chrome and silico-chrome 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 important plants which produce chromite based refractories are Tata Steel Ltd (formerly OMC Alloys), Orissa Industries Ltd, Bhilai Refractories Ltd, Burn Standard Co. Ltd, Joglekar Refractories and Ceramics (P) Ltd and Associated Ceramics Ltd.

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

Ferro Alloys Corpn. Ltd, Garividi, Andhra Pradesh; GMR Technologies & Ind. Ltd, Srikakulam, Andhra Pradesh; Jindal Steel & Power Ltd, Raigarh, Chhattisgarh; Standard Chrome Ltd, Raigarh, Chhattisgarh; SAL Steel, Kachchh-Bhuj,

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

In February 2017, Greenfield Ferro-chrome plant of 55,000 TPA capacity at Gopalpur of M/s Tata Steel Ltd commenced production. Chromite mine at Sukinda became the first unit to obtain Integrated Management System (IMS) certification (ISO 9001:2015, ISO 14001:2015 and OHSAS 18001:2007). Tata Steel Ltd, FACOR and Indian Metals & Ferro Alloys Ltd, (IMFA) the three major producers of 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.

As per Annual Report 2015-16 of M/s Tata Steel Ltd, the construction of the first phase of the ferrochrome plant of 55,000 TPA in Gopalpur is in full swing and is expected to be commissioned in 2017-18.

An agreement has been executed between Odisha Mining Corp. Ltd (OMC) and M/s MBE-LMT (Formerly HWIPL) on 30-10-2009 for new stand alone chrome ore beneficiation plant of feed capacity of 1.5 lakh TPA at South Kaliapani to upgrade low grade chrome ore to high grade. Vishnu Chemicals Ltd has plants at Medak, Visakhapatnam (Andhra Pradesh) and Bhilai (Chhattisgarh) which produce 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
FERRO CHROME/CHARGE CHROME	
Andhra Pradesh/Telangana	
Andhra Ferro Alloys Ltd, Kothavalasa, Distt. Vizianagaram.	N.A.
Cronimet Alloys India Ltd, Ravivalasa Distt. Srikakulam.	Lumps : Cr_2O_3 40% to 50% Fines : Cr_2O_3 40% to 52% Concentrates : Cr_2O_3-40%
Ferro-Alloys Corp. Ltd, Shreeram Nagar, Distt. Vizianagaram.	Lumps : Cr_2O_3 38% to 40% Fines : Cr_2O_3 38% to 40% Friable : Cr_2O_3 48% to 50% Concentrates : Cr_2O_3 48% to 50%
JSL Ltd, (formerly Jindal Stainless Steel Ltd,) Jindal Nagar, Distt. Vizianagaram.	Lumps : Cr_2O_3 38% Cr:Fe : 2 : 9
Metkore Alloys & Industries Ltd, Ravivalasa, Distt. Srikakulam.	N.A.
Nav Bharat Ventures Ltd, Paloncha, Distt. Khammam.	Lumps: Cr_2O_3 28-42% Fines: Cr_2O_3 48-50%, 52-54%
GMR Technologies & Industries Ltd, Ravivalasa, Distt. Srikakulam.	Lumps: Cr_2O_3- 38-45% Fines: Cr_2O_3- 45-55 %
VBC Ferro Alloys Ltd, Rudragram, Distt. Medak, Telangana.	Lumps: Cr_2O_3 36-52%
Chhattisgarh	
Jindal Steel & Power Ltd, Raigarh.	Lumps : Cr_2O_3+38% Cr:Fe : 2 : 9 Fines : Cr_2O_3+52%, Cr:Fe : 2.6
Deepak Ferro Alloys Ltd, Urla, Distt. Raipur.	Lumps : Cr_2O_3 36-40% Fines : Cr_2O_3 48-52%
Gujarat	
S.A.L. Steel Ltd, Bharapur, Gandhidham..	N.A.
Jammu & Kashmir	
Shree Sitaram Industries Pvt. Ltd Distt. Samba.	Lumps : $Cr_2O_3$40% to 52% Fines : $Cr_2O_3$40% to +52%,
Tawi Chemicals Industries Distt. Samba.	N.A.
Odisha	
Balasore Alloys Ltd, (formerly Ispat Alloys Ltd,) Balgopalpur, Distt. Balasore.	Lumps : Cr_2O_3 -40% Fines : Cr_2O_3 -40 to +52%
Ferro Alloys Corp. Ltd, Charge Chrome Division, Randia, Distt. Bhadrak.	Lumps : Cr_2O_3 N.A.; Friable : Cr_2O_3 40% & above; Concentrates : N.A.
IDCOL Ferro Chrome & Alloys Ltd, Jajpur Road, Distt. Cuttack.	Cr_2O_3 : 42-52% SiO_2 6% max.
Indian Metals & Ferro Alloys Ltd, (Formerly, Indian Charge Chrome Ltd) Choudwar, Distt. Cuttack.	Lumps: Cr_2O_3 : -40 to >52% SiO_2 : 15% max. Fines: 40 to 50% & above
Indian Metals & Ferro Alloys Ltd, Therubali, Distt. Raygada	Lumps: Cr_2O_3 : -40 & 40 to 52% Fines: Cr_2O_3 : -40 & 40 to >52% Concentrates: N.A.
Rohit Ferro Tech. Ltd, (Unit 2) Duburi, Distt. Jajpur.	Lumps, fines & concentrates

(Contd.)

Table - 16 (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 : 0-40 mm
West Bengal	
Rohit Ferro Tech Ltd, (Unit 1) Bishnupur, Distt. Bankura.	Lumps, fines & concentrates
Shri Vasavi Industries Ltd, Distt. Bankura.	N.A.
REFRACTORY	
Chhattisgarh	
SAIL Refractories Unit, Marauda, Distt. Durg.	Friable lumps : Cr_2O_3 : 52-54% min. SiO_2 : 5% max.
Vishva Vishal Engineering Ltd, Bhilai, Durg.	Cr_2O_3 : 50%, SiO_2 : 4.5% max. Fe_2O_3 : 8%
Maharashtra	
Joglekar Refractories & Ceramics (P) Ltd, Rabale, Distt. Thane.	Lumps Cr_2O_3 44% min. CaO < 2%, Fe_2O_3 < 21% Imported sand - 30 to +85 mesh, Cr_2O_3 45% min. SiO_2 < 1%, Fe_2O_3 < 27%
Odisha	
Aarti Steels Ltd, Plot No. 18/1B, Sector-10, CDA, Cuttack-753 014.	N.A.
Balasore Alloys Ltd, Balgopalpur, Balasore	N.A.
Orissa Industries Ltd, Lathikata Works, Distt. Sundargarh.	Cr_2O_3 : 52-54% 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. Jharsududa.	Cr_2O_3 : 48-50% min.
Shree Chem Industries (Pvt) Ltd, Mandiyakudar, Distt. Sundargarh.	Cr_2O_3 : 54% SiO_2 : 5-9% min.
Kalinga Ferro Ispat Pvt Ltd, Mandia, Distt. Jajpur	Fines Cr_2O_3 : 40-52% & 52% & above,
Khemka Refractories Pvt. Ltd, Kamakhyanagar - 759 018, Distt. Dhenkanal.	Cr_2O_3 : 52% min., Fines
Larsen & Toubro Ltd, Kansbahal - 770 034, Distt. Sundergarh.	N. A.
T. S. Alloys Ltd, Anantpur, Distt. Cuttack.	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 2015-2020. As per the present Export-Import Policy, the imports of chromium ore lumps, friable ores and concentrates are freely allowed. The export policy on chromite is stated as follows:

Tariff Item HS Code		Item	Export Policy	Nature of Restriction
26100000	(a)	Chrome ore other than	Restricted	Exports permitted under
		(i) beneficiated chrome ore fines/concentrates (maximum feed grade to be less than 42% Cr_2O_3); and		licence other than categories given below
		(ii) those categories of chrome ores mentioned as permitted through STEs (State Trading Enterprises)		
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 about 5 billion tonnes in terms of chromium metal content. Countries that possess sizeable quantities of resources are Kazakhstan (46%), South Africa (40%) and India (11%). These two countries concentrated about 86% of world's 500 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)	**5,00,000**
India	54,000
Kazakhstan	2,30,000
South Africa	2,00,000
Turkey	12,000
USA	620
Other countries	NA

Source: *Mineral Commodity Summaries, 2017.*
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 Turkey, Kazakhstan and India. Finland, Brazil and Albania are other important producers. In Europe, Finland and Albania are the major producing countries.

The world production of chromite increased marginally to 35 million tonnes in 2015 as compared to 33 million tonnes during the previous year. South Africa was the leading producer, contributing about 44% to the total world production, followed by Turkey (19%), Kazakhstan (15%), and India (8%). Other significant producers were Finland, Brazil and Albania (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	2013	2014	2015
World: Total	**31014**	**33330**	**35251**
Albania	530	684	640
Australia	355	-	-
Brazil	486	717	700[e]
China[(e)]	200	200	200
Finland	982	1035	946
India*[*]	2878	2164	2894
Iran	344	359	350
Kazakhstan	5255	5411	5383
Oman	788	751	443
Pakistan[e]	490	350	330
Russia	360	380	380[e]
South Africa	13645	14038	15684
Turkey	4141	6611	6600[e]
Zimbabwe	355	408	443[e]
Other countries	206	221	258

Source: *World Mineral Production, 2011-15.*
** Production of chromite in India in 2013-14, 2014-15 and 2015-16 was 2.88 million tonnes, 2.16 million tonnes and 2.89 million tonnes, respectively.*

FOREIGN TRADE

Exports

Exports of chromite increased sharply to 72 thousand tonnes in 2015-16 from 25 thousand tonnes in the previous year. Out of total chromite exported in 2015-16, the share of about 97% was of chromite concentrate, while chromite ore (others) accounted for 3%. There were negligible export of chrome ore lumps in 2015-16. Exports were mainly to China (80%) and Japan (20%). In 2015-16, 58 tonnes of chromium & alloys (scrap) were exported registering decrease of 38% from that of the preceding year. Export of chromium & Alloys (scrap) were mainly to Italy (34%), Malaysia (17%) and Ireland (16%).

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

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**25361**	**659259**	**71839**	**1314084**
China	280	7084	57696	1024966
Japan	23036	484952	14128	288683
South Africa	7	149	10	228
Egypt A. Rep.	-	-	5	193
Chile	-	-	++	14
Korea, Rep. of	1422	147861	-	-
Spain	340	10014	-	-
Vietnam	240	7959	-	-
Hong Kong	17	574	-	-
Colombia	12	485	-	-
Other countries	7	181	-	-

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	-	-	++	**14**
Chile	-	-	++	14

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**8997**	**330707**	**69972**	**1287852**
China	280	7084	55844	999169
Japan	6938	165174	14128	288683
Korea, Rep. of	1422	147861	-	-
Spain	340	10014	-	-
Hong Kong	17	574	-	-

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**16364**	**328552**	**1867**	**26218**
China	-	-	1852	25798
South Africa	7	149	10	228
Egypt Arab Rep.	-	-	5	192
Japan	16098	319778	-	-
Vietnam	240	7959	-	-
Colombia	12	485	-	-
UAE	7	181	-	-

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**94**	**72047**	**58**	**50866**
Italy	5	5496	20	19860
Malaysia	13	9135	10	7887
Ireland	2	1607	9	7532
Brazil	2	2312	5	5749
Peru	10	9889	5	4659
Indonesia	20	14735	4	2757
Kenya	1	563	1	510
Pakistan	-	-	1	411
Israel	1	344	1	395
Thailand	-	-	1	393
Other countries	40	27966	1	713

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**++**	**1676**	**++**	**14**
Sri Lanka	-	-	++	13
France	++	1676	-	-
Other countries	-	-	++	1

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**1**	**782**	**++**	**9**
Vietnam	-	-	++	9
Saudi Arabia	1	780	-	-
UAE	++	2	-	-

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**93**	**69589**	**58**	**50843**
Italy	5	5496	20	19860
Malaysia	13	9135	10	7887
Ireland	2	1607	9	7532
Brazil	2	2312	5	5749
Peru	10	9889	5	4659
Indonesia	20	14735	4	2757
Kenya	1	563	1	510
Pakistan	-	-	1	411
Israel	1	344	1	395
Thailand	-	-	1	393
Other countries	39	25508	1	690

Imports

Imports of chromite decreased sharply to 188 thousand tonnes in 2015-16 from 243 thousand tonnes in the previous year. Out of total quantity of chromite imported in 2015-16, lumpy chromite accounted for 82%, while concentrate and other forms accounted for the remaining 18%. Imports were mainly from South Africa (75%) and Oman (17%). Imports of chrome ore concentrate were mainly from South Africa (99%) and USA (1%). Imports of chromium and alloys in 2015-16 were 840 tonnes as compared to 1001 tonnes in the previous year. Imports were mainly from Russia (61%), UK (17%) and China (13%). Imports of chromium and scrap were sharply decreased to 7 tonnes in 2015-16 from 24 tonnes in 2014-15 (Tables-27 to 34).

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

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**242685**	**2871479**	**187663**	**2266406**
South Africa	113635	1595557	140116	1787926
Oman	126825	1230040	31946	260243
Pakistan	350	12386	7859	105131
Madagascar	-	-	3185	42451
Albania	515	8734	2151	27659
Netherlands	109	3079	786	24030
Turkey	-	-	934	10166
Iran	-	-	519	5389
USA	-	-	108	2196
Ecuador	-	-	54	1108
Other countries	1251	21683	5	107

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**195219**	**2157413**	**153487**	**1714028**
South Africa	69682	939453	110278	1312822
Oman	124197	1196625	31946	260243
Pakistan	200	6947	7659	97749
Albania	515	8734	2151	27659
Turkey	-	-	934	10166
Iran	-	-	519	5389
Philippines	625	5654	-	-

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**11331**	**196110**	**11195**	**206037**
South Africa	11331	196110	11087	203841
USA	-	-	108	2196

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**36135**	**517956**	**22981**	**346341**
South Africa	32622	459994	18751	271263
Madagascar	-	-	3185	42451
Netherlands	109	3079	786	24030
Pakistan	150	5439	200	7382
Ecuador	-	-	54	1108
Denmark	-	-	5	107
Oman	2628	33415	-	-
UK	168	5129	-	-
Belgium	152	4358	-	-
China	204	4262	-	-
Other countries	102	2280	-	-

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**1001**	**640994**	**840**	**540333**
Russia	720	392877	509	269784
UK	90	57544	139	91784
China	79	46365	113	56904
Germany	17	42613	18	37610
USA	11	24469	10	29224
France	36	28931	35	20390
Singapore	6	17168	5	19847
Japan	5	9201	6	10164
Netherlands	5	2674	5	2731
Korea, Rep. of	20	11115	++	1482
Other countries	12	8037	++	413

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**885**	**529153**	**760**	**440797**
Russia	700	380125	509	269784
UK	85	51015	106	61280
China	33	17730	111	55119
Germany	15	30955	12	27128
USA	10	17556	6	11481
Japan	5	9020	6	9825
Netherlands	5	2674	5	2731
France	-	-	5	2654
Singapore	1	3082	++	745
Korea, Rep. of	20	10888	-	-
Other countries	11	6108	-	-

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**92**	**89759**	**73**	**77338**
UK	5	5548	33	29371
France	36	28931	30	17736
USA	1	6724	1	12156
Germany	2	11658	6	10432
Singapore	1	2287	1	3673
China	26	19703	2	1785
Korea, Rep. of	++	227	++	1482
Japan	-	-	++	339
Liechtenstein	++	325	++	211
Switzerland	-	-	++	153
Other countries	21	14356	-	-

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**24**	**22082**	**7**	**22198**
Singapore	4	11799	4	15428
USA	++	189	3	5587
UK	++	981	++	1134
Hong Kong	-	-	++	49
China	20	8932	-	-
Japan	++	181	-	-

FUTURE OUTLOOK

The Report of the Working Group for 12th Plan Period, Planning Commission, offlate or 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 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.

As per the Annual Report 2016-17 of M/s Balasore Alloys Ltd, the demand for ferrochrome is driven primarily by the demand for stainless steel. Global stainless steel production growth is expected to average +2.6% per annum up to 2021, driven mainly by China (due to relative scarcity), demand for virgin chrome units will remain robust.