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(Part- III : MINERAL REVIEWS)

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GRAPHITE

(FINAL RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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25 Graphite

Graphite, also known as plumbago or blacklead or mineral carbon, is a stable form of naturally occurring carbon. Structurally, graphite is known to crystalise in hexagonal system and occurs in layered & lamellar form with grey-to-black metallic lustre and a greasy feel. Natural graphite is categorised into two commercial varieties (i) crystalline (flaky) graphite and (ii) amorphous graphite. Both flaky and amorphous varieties of graphite are produced in India. The quality of graphite depends upon its physical qualities and carbon content. Besides natural graphite, there is synthetic or artificial graphite which is manufactured on a large-scale in electric furnaces, using anthracite or petroleum coke as raw feed.

RESOURCES

Graphite occurrences are reported from various States but the deposits of economic importance are located in Andhra Pradesh, Jharkhand, Karnataka, Kerala, Odisha, Rajasthan and Tamil Nadu.

As per the UNFC system, the total resources of graphite as on 1.4.2013 is placed at about 188.67 million tonnes, out of which 8.47 million tonnes are in the Reserves category and 180.20 million tonnes are placed under Remaining Resources category. Resources containing +40% fixed carbon constitute about 2.51 million tonnes and resources analysing 10-40% fixed carbon constitute 36.30 million tonnes. The balance 149.87 million tonnes fall under 'Others', 'Unclassified' and 'Not-known' grades. Arunachal Pradesh accounts for 39% of the total resources which is followed by Jammu & Kashmir (33%), Odisha (10%), Jharkhand (9%) and Tamil Nadu (4%). However, in terms of reserves, Jharkhand has the leading share of about (52%) followed by Tamil Nadu 41% and Odisha (6%) (Table-1).

EXPLORATION & DEVELOPMENT

During 2014-15, GSI has estimated inferred resources of 4.73 million tonnes with 9 to 11.68% fixed carbon in Tikri, Gauthana, Chiklar in Betul district of Madhya Pradesh.

During the same period, GSI carried out prospecting stage investigation (G-4) in Tai area,Siang district, Arunachal Pradesh. A total of 0.75 sq km of detailed mapping followed by pitting & trenching and 400 m drilling has been carried out at 1:2000 scale. Also, large scale mapping at 1:12,500 has been carried out in Tai-Badak-Yagri area covering 55 sq km area during the year. Graphite schist intersected at various depths with thickness varies from 0.5 to 8 m and fixed carbon ranges between 10.59% to 11.70% .

In Andhra Pradesh, a G3 stage investigation for graphite was carried out in Burugubanda area.Two graphite gneiss lenses were reported in the area. These graphite gneiss lenses extend over a length of about 180 m having a width up to 12 m each. The mineralisation is confined to the E-W trends. Tungesten mineralisation is also observed along with these graphite gneisses. Five boreholes were drilled in the area and graphite mineralisation intersected at 60 m depth. 50 samples were sent to IBM, Nagpur for analysis. One core sample analysed 13.9% of fixed carbon. Few more boreholes are planned for the future course of action.

In Tamil Nadu, a G3 stage investigation for reassessment of graphite mineralisation was carried out by drilling in Arasanur block in Sivaganga district. So far, drilling of 8 boreholes were completed and also pitting and trenching has been carried out in the area. Samples were drawn from cores, pits and trenches of the area and sent for analysis. Analytical result is under progress. Graphite of the area mostly occurs as flakes.

PRODUCTION STOCKS & PRICES

Production of graphite at about 117 thousand tonnes in 2014-15 decreased by 20% as compared to that of the preceding year. The output of graphite is reported in terms of run-of-mine (r.o.m.) which contains varying carbon content.

In all, there were 10 reporting mines in 2014-15 as against 12 in the previous year. Four principal producers accounted for 99% of the total output during the year. The share of the Public Sector in the total output was 62% in 2014-15 as compared to 60% in the previous year.

About 97% of the total production in 2013-14 was produced from three mines, each reported more than 10,000 tonnes of annual production, while 2% was contributed by one mine, in the production range of 2,001 to 5,000 tonnes per annum. The remaining output of one percent was reported by 6 mines, each of which produced below 2,000 tonnes annually.

Tamil Nadu was the leading producing State that contributed a major share of about 63% to the total output during 2014-15 followed by Jharkhand (36%). The remaining one percent was contributed by Odisha and Kerala (Tables - 2 to 5).

Mine-head closing stock for the year 2014-15 was 106 thousand tonnes as against 125 thousand tonnes in the previous year (Table - 6).

The average daily employment of labour during 2014-15 was 181 against 257 in the preceding year.

Domestic prices of graphite are furnished in the General review on 'Prices'.

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

(In 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	**5435659**	**3013**	**3030005**	**8468677**	**9794555**	**3427932**	**3629229**	**738607**	**7366997**	**19280299**	**135967175**	**180204794**	**188673471**
By Grades													
+ 40% F.C.	1121513	-	266338	1387851	148667	57820	50942	338686	286824	237440	-	1120379	2508230
10-40% F.C.	3861262	3013	2459580	6323855	9064107	3159469	3242277	353765	2703478	10659604	802666	29985366	36309221
Others	258346	-	57000	315346	106094	18750	25299	-	3300501	3297811	-	6748455	7063801
Unclassified	194538	-	247087	441625	444415	191893	305847	6320	5882	3861529	62246194	67062080	67503705
Not-known	-	-	-	-	31272	-	4864	39836	1070312	1223915	72918315	75288514	75288514
By States													
Andhra Pradesh	-	-	-	-	-	-	1135	-	1122	205487	-	207744	207744
Arunachal Pradesh	-	-	-	-	-	-	-	-	-	-	72758257	72758257	72758257
Gujarat	-	-	-	-	-	-	-	-	2520805	835000	-	3355805	3355805
Jammu & Kashmir	-	-	-	-	-	-	-	-	-	1059520	61681035	62740555	62740555
Jharkhand	2600399	-	1781512	4381911	364821	28435	1947344	2750	1878625	6657805	1223255	12103035	16484946
Karnataka	-	-	-	-	7696	39570	90	-	18200	-	-	65556	65556
Kerala	-	-	133980	133980	-	8376	148762	-	1088550	312106	-	1557794	1691774
Madhya Pradesh	-	-	-	-	-	-	-	-	-	1006660	-	1006660	1006660
Maharashtra	-	-	-	-	-	-	-	-	-	1160000	-	1160000	1160000
Odisha	178371	3013	304063	485447	9345730	3312065	1363492	696021	838559	2631478	304628	18491973	18977420
Rajasthan	-	-	-	-	47600	-	165920	-	250000	1450034	-	1913554	1913554
Tamil Nadu	2656889	-	810450	3467339	28708	39486	2486	29136	647500	3866390	-	4613707	8081046
Telangana	-	-	-	-	-	-	-	-	123636	95818	-	219455	219455
Uttarakhand	-	-	-	-	-	-	-	10700	-	-	-	10700	10700

Figures rounded off.

Table – 2 : Principal Producers of Graphite 2014-15

Name & address of producer	Location of mine	
	State	District
Tamil Nadu Minerals Ltd, 31, Kamarajar Salai, Chepauk, Chennai-600 005, Tamil Nadu.	Tamil Nadu	Sivagangai
K.K. Poddar, 3 P, Shree Gopal Complex, Court Road, Ranchi-834 001, Jharkhand.	Jharkhand	Palamu

(Contd.)

Table - 2 : (Concld.)

Name & address of producer	Location of mine	
	State	District
Shishir Kumar Poddar, Tirupati Carbons & Chemicals Pvt. Ltd 4L, Shree Gopal Complex, Court Road, Ranchi-834 001 Jharkhand.	Jharkhand	Palamu
Pramod Kumar Agrawal Shantikunj Farm Road, Modipara-768 001 Sambalpur, Odisha.	Odisha	Nawapara

Table – 3 : Production of Graphite, 2012-13 to 2014-15 (By States)

(Qty in tonnes; Value in ₹'000)

State	2012-13		2013-14		2014-15(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**134735**	**84133**	**146390**	**102471**	**116512**	**76535**
Chattisgarh	-	-	1403	631	-	-
Jharkhand	55855	26636	43716	20203	41423	22034
Karnataka	3241	3889	2205	2646	-	-
Kerala	-	-	-	-	50	400
Odisha	6530	3816	10521	5927	2083	1302
Tamil Nadu	69109	49792	88545	73064	72956	52799

Table – 4 : Production of Graphite, 2013-14 and 2014-15 (By Sectors/States/Districts)

(Qty in tonnes; Value in ₹ '000)

State/District	2013-14			2014-15 (P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	**12**	**146390**	**102471**	**10**	**116512**	**76535**
Public sector	2	87995	72771	1	71706	51987
Private sector	10	58395	29700	9	44806	24548
Chhattisgarh	**1**	**1403**	**631**	**1***	**-**	**-**
Surguja	1	1403	631	1*	-	-
Jharkhand	**6**	**43716**	**20203**	**3**	**41423**	**22034**
Palamu	6	43716	20203	3	41423	22034
Karnataka	**1**	**2205**	**2646**	**2***	**-**	**-**
Mysuru	1	2205	2646	2*	-	-
Kerala	-	-	-	**1**	**50**	**400**
Ernakulam	-	-	-	1	50	400
Odisha	**2**	**10521**	**5927**	**1**	**2083**	**1302**
Nuapada	1	3421	1546	1	2083	1302
Rayagada	1	7100	4381	-	-	-
Tamil Nadu	**2**	**88545**	**73064**	**2**	**72956**	**52799**
Madurai	1	550	292	1	1250	812
Sivagangai	1	87995	72772	1	71706	51987

** : Only labour reported during the year.*

Table – 5 : Production of Graphite, 2013-14 & 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)
India	**12**	**10**	**146390**	**116512**	**100.00**	**100.00**	**–**	**–**
Up to 1000	3	5	550	50	0.37	0.04	0.37	0.04
1001-2000	1	1	1403	1250	0.96	1.07	1.33	1.11
2001-5000	4	1	12024	2083	8.21	1.79	9.54	2.90
5001-10000	2	-	16360	-	11.18	-	20.72	2.90
Above 10000	2	3	116053	113129	79.28	97.10	100.00	100.00

Table – 6 : Mine-head Stocks of Graphite, 2013-14 & 2014-15
(By States)

(In tonnes)

State	2013-14	2014-15(P)
India	**125414**	**106410**
Chhattisgarh	5687	4281
Jharkhand	7326	7234
Karnataka	6444	-
Kerala	67	320
Odisha	4757	1463
Tamil Nadu	101133	93112

MINING & MARKETING

Graphite mines, barring a few underground mines are mostly small and opencast.

Active mining centres of graphite are in Latehar & Palamu districts in Jharkhand; Bargarh, Nuapada, Rayagada & Balangir districts in Odisha; and Madurai & Sivagangai districts in Tamil Nadu. In Jharkhand, mining activities are concentrated mostly around village Sokara in Palamu district. It is a disseminated deposit of flaky graphite containing 5 to 20% Fixed Carbon (F.C.). In Odisha, areas in and around Balangir are the chief mining centres where several graphite grades are produced. At Balangir, a few opencast workings are deeper than 45 m from surface and the r.o.m. from such mines generally contains 10 to 20% F.C. Sargipalli underground mine in Sambalpur district, operated by M/s T.P. Mineral Industries (TPMI), produced graphite, analysed up to 40% F.C. in the past. Water seepage beyond 6 m depth is the main problem faced by almost all mine owners in Odisha.

Graphite of Balangir and Sambalpur districts is utilised mostly by the Graphite Crucible Industry. The technological changes in recent years have considerably reduced the use of graphite as a lubricant. However, recycled graphite is still used in production of clay- binded graphite crucibles.

BENEFICIATION

Graphite occurs generally admixed with country rocks, and hence, it requires beneficiation for obtaining desired grade for various end-uses. Processes for graphite beneficiation depend upon nature and association of gangue minerals present. The common processes adopted are washing, sorting, tabling, acid leaching and froth flotation. Amongst these, froth flotation process is used widely as it helps in producing a fairly high-grade graphite concentrate. Sometimes, beneficiated concentrate is further enriched by chemical treatment (acid leaching, chlorination, etc.) to obtain a very high-grade concentrate containing 98 to 99% F.C.

Prominent beneficiation plants for graphite in India are Chota Nagpur Graphite Industries and Carbon & Graphite Products, Daltonganj; Agrawal Graphite Industries, Gandhamardhan Graphite Udyog and T. P. Minerals Private Limited, Sambalpur; Tamil Nadu Minerals Ltd (TAMIN), Sivagangai, etc.

The r.o.m., containing an average of about 10% F.C. has to be invariably beneficiated before marketing. Indigenously fabricated equipment is used generally to upgrade the r.o.m. to produce marketable grade graphite which contains normally 70 to 80% F.C. About 92% F.C. product has been obtained by many producers after repeated cycles of beneficiation. A few plant owners have claimed to have obtained product containing as high as 95% F.C.

Beneficiation plants in Odisha seem to have been designed for treating +10% F.C. graphite (r.o.m.). In practice, it is seen that lower grade graphite having +5% F.C. is blended with higher grades to meet the requirements of beneficiation plant, i.e., +10% F.C. Thus, low-grade ore analysing +5% F.C. is also used.

Tamil Nadu Minerals Ltd (TAMIN) produced flaky graphite from a mine in Sivagangai district in Tamil Nadu. The beneficiation plant located adjacent to the mine site is designed to produce 8,400 tpy of natural graphite concentrate containing 96% F.C. with 92% recovery from r.o.m.

USES & SPECIFICATIONS

Traditional uses of graphite are in crucibles, foundries, pencils, etc. More sophisticated applications of graphite are in refractories used to make steel, cement and glass, expanded graphite-based sealing gaskets, graphitised grease, braid, brushes, brake lining, etc. It is also used for speciality applications such as in the nuclear industry, soil conditioners and graphite foils, which is used for sealing in the chemical and petrochemical industries as well as in the energy, engineering and automotive industries. It is also used in a minor amounts as a vital additive for producing foundry coatings to prevent fusion of liquid metal with sand at the mould or core face. Such coatings are either applied by spraying or painting in the form of suspension or by dusting or by rubbing as dry powders. Graphite used for coating is of high quality which does not peel off as flakes on drying and imparts a smooth surface to the casting. Graphite, a major additive to many coating systems, is known for its multifarious functions, such as, refractory, lubricant, thermal conductor, electrical conductor, UV shield, electromagnetic pulse shield, corrosion shield and pigment. It is also used as moderator in nuclear reactors and in Lithium-ion (Li-ion) batteries which is used in the electric vehicle, which require high purity flake graphite in their anode material.

The BIS has prescribed the following specifications of graphite for use in various industries:

IS: 1132-1985 (Reaffirmed 2008) - graphite for use in Graphite Crucible Industry;

IS:1305-1984 (Reaffirmed 2012) - graphite for use in foundry coatings;

IS: 14852-2000 (Reaffirmed 2010) - flaky graphite for Refractory Industry;

IS: 495-1967 (First Revision, Reaffirmed 2007) - graphite flakes for lubricants;

IS: 62-2006 (First Revision, Reaffirmed 2011) - graphite for paints; and

IS: 2079-1982 (First Revision, Reaffirmed 2010) - graphite for pencil slips.

The specifications of graphite adopted for various industrial purposes are detailed as below:

Specifications of Graphite

End product	Percentage of graphite used	Quality of the graphite used	
		Fixed Carbon (F.C.)	Size (micron)
Mag-Carb refractories	12	87-90%	150-710
Alumina-Carb (graphitised)	8-10	85% min.	150-500
alumina refractories			
Clay-bonded crucibles	60-65	+80% mesh	-20 to +100
Silicon carbide crucibles	35	80-89%	+150
Expanded (or flexible) graphite foils and products based thereon (e.g. sealing gaskets in refineries, fuel pumps, automobiles)	100	90% min. (preferably +99%)	250-1800
Pencils	50-60	+95- 98%	50 max.
Brake-linings	1-15	98% min.	75 max.
Foundry	–	40-70%	53-75
Batteries			
a) Dry cells	–	88% min.	75 max.
b) Alkaline	–	98% min.	5-75
Brushes	–	Usually 99%	Usually less than 53
Lubricants	–	98-99%	53-106
Sintered products (e.g. clog wheels)	–	98-99%	5
Paint	Up to 75	50-55% 75% min.	Amorph-ous powder flake
Braid used for sealing (e.g. in ship)	40-50	95% min.	–
Graphitised grease (used in seamless steel tube manufacturing)	–	+99%	38 max.
Colloidal graphite	100	99.9%	Colloidal

CONSUMPTION

Consumption data on beneficiated graphite concentrates are not available. As per the information received from various graphite consuming units and estimates, the consumption of various grades of graphite during 2012-13 to 2014-15 ranged from 50,300 tonnes to 52,900 tonnes. Out of the total consumption in 2014-15, the Graphite product (Crucible Industry) accounted for 34,700 tonnes (69%), Chemical Industry 5200 tonnes (10%), Refractory Industry for 7,400 tonnes (15%) and Foundry Industry 1,000 tonnes (2%). Industrywise consumption data are provided in Table - 7.

SUBSTITUTION

In principle, it is possible to substitute graphite by either its synthetic graphite, produced primarily from high carbon precusors such as petroleum coke and coal tar pitch. (e.g. in batteries or for increasing the carbonof steel) or by replacing the product as in the case of pencils or by other compounds as in high temperature applications (e.g. refractories). In the later case, it is difficult to fully substitute graphite as it is tough to replicate the same level of performance that graphite provides.

Table - 7 : Consumption* of Graphite 2012-13 to 2014-15 (By Industries)

(In tonnes)

Industry	2012-13	2013-14(R)	2014-15(P)
All Industries	**52900**	**52800**	**50300**
Chemicals	7700(3)	7700(3)	5200(3)
Dry cell battery	400(3)	400(3)	400(3)
Electrode	600(8)	600(10)	500(10)
Foundry	1000(6)	1000(6)	1000(6)
Graphite products (Crucible)	34700(4)	34800(4)	34700(4)
Graphite products (Pencil)	500(1)	500(1)	500(1)
Refractory	7300(27)	7100(27)	7400(27)
Others (asbestos products, chemicals, paint, paper, pesticide, pharmaceuticals, and rubber)	700(15)	700(16)	600(16)

Figures rounded off.

Figures in parentheses denote the number of units in organised sector .

*(*Paucity of data hence consumption may not be complete).*

WORLD REVIEW

The world resources of graphite are believed to exceed 800 million tonnes of recoverable reserves. However, world reserves of graphite have been placed at 230 million tonnes of which Turkey accounts for 39% followed by Brazil 31%, China 24% and India 3% (Table-8).

World production of graphite was 2.1 million tonnes in 2014. China continued to be the leading producer, with a share of about 85% which is followed by India (5%) and Brazil (4%) (Table-9).

Canada was the leading country for natural graphite development with a favourable outlook for new mines. Eight companies reportedly were exploring for graphite.

Brazil was the second leading country providing new natural graphite supply with a new 40,000 tonnes per year mine being considered by Magnesite Refractories SA.

Table – 8 : World Reserves of Graphite (Natural) (By Principal Countries)

(In '000 tonnes)

Country	Reserves
World : Total (rounded)	**230000**
Brazil	72000
China	55000
India*	8000
Madagascar	940
Mexico	3100
Turkey	90000

Source: Mineral Commodity Summaries, 2016.

Reserves in Canada, Korea, Dem P.R., Russia, Norway, Sri Lanka, Ukraine and Zimbabwe are included with World total.

**India's resources of graphite as per UNFC system as on 1.4.2013 are placed at about 1,88,673thousand tonnes.*

Table – 9 : World Production of Graphite (Natural) (By Principal Countries)

(In '000 tonnes)

Country	2012	2013	2014
World : Total	**2134**	**2154**	**2117**
Brazil @	88	92	78
Canada[(e)]	20	20	20
China[(e) #]	1800	1800	1800
India *	135	146	104[e]
Korea, Dem. P.R. of	10	10	10
Madagascar	3	6	6
Mexico	8	7	9
Norway	7	6	8
Russia[(e)]	14	14	14
Sri Lanka	4	3	3
Turkey	32	29	29
Ukraine[(e)]	5	7	14
Zimbabwe	7	7	7
Other countries	1	7	15

Source: *World Mineral Production, 2010-2014.*

@ Including beneficiated and directly shipped material.

 # Including flake graphite.

** Crude.*

India's production of graphite in 2012-13, 2013-14 and 2014-15 was 135 thousand tonnes,146 thousand tonnes and 117 thousand tonnes, respectively.

FOREIGN TRADE

Exports

In 2014-15, exports of graphite (natural) drastically increased to 2,668 tonnes as compared to 820 tonnes in the previous year. Graphite (natural) was exported mainly to Japan (7%), Germany (4%), UK (3%) and Netherlands (2%). The exports of graphite (artificial) is almost at the same level to 17,048 tonnes in 2014-15 from 17,040 tonnes in the previous year. Graphite (artificial) was exported mainly to Germany (34%), USA (12%),Iran & UK (10% each),Oman (6%) and Bangladesh (4%).

The exports of graphite crucibles increased marginally to 103 tonnes in 2014-15 from 85 tonnes in the preceding year, while those of silicon carbide crucibles increased marginally to 3,478 tonnes from 3,240 tonnes in the previous year. Silicon carbide crucibles were exported mainly to Iran (15%), Turkey, UK, Rep. of Korea (8% each). Exports of graphite bricks and shapes were at 304 tonnes in 2014-15 compared to 100 tonnes in the preceding year. Graphite bricks and shapes were mainly exported to Rep. of Tanzania (59%), Nepal (23%) and rep. of Congo (10%) (Tables -10 to 14).

Imports

Imports of graphite (natural) increased marginally to 28,549 tonnes in 2014-15 from 22,916 tonnes in the preceding year. Imports of graphite (artificial) increased considerably to 29,350 tonnes in 2014-15 from 18,317 tonnes in the previous year. Graphite (natural) was mainly imported from China (86%). Imports of graphite (artificial) were mainly from China (49%), Poland (17%), Norway (13%) and Germany (8%).

Imports of graphite bricks and shapes drastically increased to 126 tonnes in 2014-15 from 19 tonnes in the preceding year. Imports were mainly from China (73%). Imports of graphite crucibles decreased considerably to 1,339 tonnes in 2014-15 from 6,431 tonnes in the preceding year. China was the main supplier with 99% share. Imports of silicon carbide crucibles increased marginally to 231 tonnes in 2014-15 as compared to 181 tonnes in the previous year. Imports were mainly from, China (84%) and USA (6%) (Tables - 15 to 19).

Table – 10 : Exports of Graphite (Natural) (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**820**	**112370**	**2668**	**86578**
Germany	145	26898	108	22746
UK	69	12866	77	15353
Netherlands	112	23144	64	13969
Japan	163	9422	198	10728
Poland	32	7061	32	6522
Nepal	3	170	39	2421
USA	4	966	9	2338
New Zealand	19	4480	7	1720
Australia	9	1769	8	1668
Saudi Arabia	3	151	15	1220
Other countries	261	25443	2111	7893

Table – 11 : Exports of Graphite (Artificial) (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value ('₹ 000)
All Countries	**17040**	**1417366**	**17048**	**1637041**
Germany	1857	430292	5717	765461
USA	3283	166376	2101	182124
Iran	4767	240031	1773	75427
France	1533	111075	748	53785
UK	1277	60341	1652	96496
Belgium	80	32416	145	51372
Oman	1188	45962	1096	44484
Singapore	1	1539	271	37246
Spain	570	34491	310	33816
Bangladesh	346	17291	776	30344
Other countries	2138	277552	2459	266486

Table – 12 : Exports of Graphite Bricks & Shapes (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**100**	**1011**	**304**	**3833**
Tanzania	98	902	178	1457
Chile	-	-	3	731
Congo	-	-	30	722
Nepal	-	-	70	718
Ghana	-	-	20	180
Singapore	-	-	3	25
Other countries	2	109	-	-

Table – 13 : Exports of Graphite Crucibles (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**85**	**4745**	**103**	**3855**
Bangladesh	20	292	82	1793
Egypt	-	-	13	1714
Indonesia	-	-	2	174
UAE	10	2258	4	130
Ethiopia	-	-	1	41
Russia	-	-	1	3
Other countries	55	2195	-	-

Table – 14 : Exports of Silicon Carbide Crucibles (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**3240**	**595567**	**3478**	**674749**
Iran	434	80746	505	90725
Korea, Rep. of	305	70142	264	66012
USA	248	50547	256	65473
Turkey	181	34077	292	54760
South Africa	138	40601	155	49977
Germany	250	38957	265	49811
Egypt	252	48708	238	49729
UK	336	38716	284	29916
UAE	139	23237	111	22350
Thailand	89	17719	99	21714
Other countries	868	152117	1009	174282

Table – 15 : Imports of Graphite (Natural) (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**22916**	**1235588**	**28549**	**1335288**
China	19955	939918	24503	985800
Madagascar	1164	99777	1679	109081
Brazil	1041	91619	1476	116789
Germany	97	25150	177	41788
USA	401	48452	374	42927
Japan	13	5230	16	5508
Sri Lanka	31	3632	40	4584
Belgium	18	3590	37	6428
Mexico	-	-	54	5895
UK	30	2708	39	4667
Other countries	166	15512	154	11821

Table – 16 : Imports of Graphite (Artificial) (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**18317**	**1886075**	**29350**	**2807319**
China	9498	554238	14396	848717
Poland	2092	171262	4983	541750
Germany	979	364359	2363	492305
France	1434	217404	1173	220435
Norway	1529	87347	3753	210712
Japan	782	186392	539	160638
USA	324	66828	315	80254
Netherlands	536	76620	621	75673
UK	357	47789	466	49287
Russia	-	-	228	23551
Other countries	786	113836	513	103997

Table – 17 : Imports of Graphite Bricks & Shapes (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**19**	**1934**	**126**	**43268**
China	18	1922	92	39134
USA	-	-	8	2557
Japan	-	-	22	796
France	-	-	1	628
Italy	-	-	1	74
Germany	-	-	1	63
Belgium	1	12	1	15
Other countries	-	-	++	1

Table – 18 : Imports of Graphite Crucibles (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**6431**	**260107**	**1339**	**74886**
China	6347	253916	1319	72731
USA	57	4664	10	1318
Italy	-	-	9	713
Japan	1	231	1	124
Other countries	26	1296	-	-

Table – 19 : Imports of Silicon Carbide Crucibles (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**181**	**17985**	**231**	**21467**
China	35	4501	195	10069
USA	83	7319	15	5456
UK	3	601	9	2997
Italy	7	1048	4	1240
Spain	12	1005	2	546
Germany	14	1374	2	460
Thailand	-	-	2	426
Japan	14	1202	1	258
Turkey	-	-	1	15
Other countries	13	935	-	-

FUTURE OUTLOOK

Worldwide demand for combined natural and synthetic graphite is expected to rise along with improvements in the global economic conditions. Demand is also expected to augment further with the development of non-carbon energy applications such as batteries used in electric vehicles, electric devices and energy storage devices that use graphite. The graphite reserves having +40% fixed carbon are rather limited in the country. Detailed exploration of graphite deposits in Odisha, Jharkhand, Jammu & Kashmir and Kerala should be carried out. Cost-effective beneficiation technologies for low-grade graphite ore need to be developed. Silicon carbide-graphite crucibles are being diversified and manufactured to improve upon the use of inferior grade material with less quantity and at the same time ensuring longer life of crucible. The domestic demand of graphite r.o.m. was estimated at 2,08,000 tonnes by 2016-17 at 9% growth rate by the Working Group for the 12th Plan, Planning Commission of India.

Of late, a few emerging & important specialised applications of exfoliated graphite have been reported especially in the manufacture of sealings, gaskets, braids and brushes. New products of synthetic graphite, such as, graphite fibres/ropes and graphite insulation blankets have been introduced. Carbon-composite materials are used in very high technology areas. In the world scenario there seems to be a rapid diversification in respect of potential large-volume end-use for natural graphite, such as, in heat sinks, also called spreader shield, which is a graphite foil material that conducts heat only in two directions. It has thermal conductivity above aluminium and almost equal to copper. These are used for dissipating heat in laptop computers, flat-panel displays, wireless phones, digital video cameras, etc. Such emerging & high growth applications of graphite are certainly causing noticeable impacts on the demand & consumption patterns within the country & globally as well.