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Graphite, also known as plumbago or black lead, is a variety of naturally occurring carbon. It crystallises in hexagonal system and has a lamellar form, a grey-to-black metallic lustre and greasy feel. Natural graphite is divisible into two commercial varieties: (i) crystalline graphite and (ii) amorphous graphite. Both flaky and amorphous varieties of graphite are produced in the country. The quality of graphite is dependent upon its physical qualities as well as carbon content. In addition to natural graphite, synthetic or artificial graphite is manufactured on a large-scale in electric furnaces, using anthracite or petroleum coke as raw feed. The latter is known as Calcined Petroleum Coke (CPC).

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 1.4.2005 are placed at about 168.77 million tonnes, comprising 10.75 million tonnes in the reserves category and 158.02 million tonnes under remaining resources category. Resources containing +40% fixed carbon constitute about 1.11 million tonnes and resources analysing 10-40% fixed carbon 21.23 million tonnes. Balance resources of 146.43 million tonnes fall under 'others', 'unclassified' and 'not-known' grades. Out of total resources, Arunachal Pradesh accounts for 43% followed by Jammu & Kashmir (37%), Jharkhand (6%), Tamil Nadu (5%) and Odisha (3%). However, in terms of reserves, Tamil Nadu has leading share of about 37% followed by Jharkhand (30%) and Odisha (29%) (Table-1).

EXPLORATION & DEVELOPMENT

Exploration work has not been reported from GSI or State Directorates of Geology & Mining during 2009-10.

PRODUCTION STOCKS & PRICES

Production of graphite at about 109 thousand tonnes in 2009-10 decreased by 8% as compared to the preceding year due to less demand and temporary closure of mines. The output of graphite is reported in terms of run-of-mine (r.o.m.) which contains varying carbon content.

In all, there were 30 reporting mines in 2009-10 as against 35 in the previous year. Eight principal producers accounted for 85% of the total output during the year. The share of public sector in the total output was 47% in 2009-10 as compared to 50% in the previous year.

About 69% of the total production in 2009-10 was accrued from four mines, each producing more than 5,000 tonnes annually, while 24% was contributed by eight mines, each in the production range of 2,000 to 5,000 tonnes per annum. The remaining output of 7% was reported by 18 mines, each producing below 2,000 tonnes annually.

Tamil Nadu was the leading state contributing a major share of about 48% of the total output during 2009-10 followed by Odisha and Jharkhand contributing 26% each (Tables - 2 to 5).

Mine-head stock at the end of the year 2009-10 was 71 thousand tonnes as against 45 thousand tonnes at the beginning of the year (Table - 6).

The average daily employment of labour during 2009-10 was 376 against 463 in the preceding year. Domestic prices of graphite are furnished in the General Review on 'Prices'.

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**Table – 1 : Reserves/Resources of Graphite as on 1.4.2005
(By Grades/States)**

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	5163505	1021869	4564534	10749908	12000	78386	930118	51326	5956595	16506673	134489932	158025030	168774938
By Grades													
+ 40% F.C.	413639	77132	342807	833578	-	37000	80	-	951	238500	-	276531	1110109
10-40% F.C.	4733667	937943	3943249	9614859	12000	41386	930038	8740	1596449	8952091	73897	11614601	21229460
Others	15574	6794	210952	233320	-	-	-	-	3283001	2330151	-	5613152	5846472
Unclassified	-	-	67526	67526	-	-	-	2750	5882	3127538	61497720	64633890	64701416
Not-known	625	-	-	625	-	-	-	39836	1070312	1858393	72918315	75886856	75887481
By States													
Andhra Pradesh	-	-	1135	1135	-	-	-	-	124758	301306	-	426064	427199
Arunachal Pradesh	-	-	-	-	-	-	-	-	-	-	72758257	72758257	72758257
Gujarat	-	-	-	-	-	-	-	-	2520805	835000	-	3355805	3355805
Jammu & Kashmir	-	-	-	-	-	-	-	-	-	1059520	61681035	62740555	62740555
Jharkhand	442537	670448	2163106	3276091	-	-	720000	2750	1143701	5180124	24350	7070925	10347016
Karnataka	1308	6794	188812	196914	-	-	-	-	18200	52500	-	70700	267614
Kerala	-	8300	17762	26062	-	-	35600	-	1148350	240418	-	1424368	1450430
Madhya Pradesh	-	-	-	-	-	-	-	-	-	1006660	-	1006660	1006660
Maharashtra	-	-	-	-	-	-	-	-	-	1160000	-	1160000	1160000
Odisha	1553293	336327	1217349	3106969	12000	38900	172032	8740	103281	1954721	26290	2315964	5422933
Rajasthan	47600	-	165920	213520	-	-	-	-	250000	1450034	-	1700034	1913554
Tamil Nadu	3118767	-	810450	3929217	-	39486	2486	29136	647500	3266390	-	3984998	7914215
Uttarakhand	-	-	-	-	-	-	-	10700	-	-	-	10700	10700

Figures rounded off.

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**Table – 2 : Principal Producers of Graphite
2009-10**

Name & address of producer	Location of mine	
	State	District
Tamil Nadu Minerals Ltd, 31, Kamarajar Salai, Chepauk, Chennai - 600 005, Tamil Nadu.	Tamil Nadu	Sivaganga
Pramod Kumar Agrawal, Patnaikpara, Sambalpur Odisha.	Odisha	Bolangir Nuapada
K. K. Poddar, Poddar Niket, Bariaju Road, Ranchi, Jharkhand.	Jharkhand	Palamu
Parijat Mining Industries (India) Pvt. Ltd, Opp. Shivajee Maidan, Daltonganj, Palamu, Jharkhand - 822 101.	Jharkhand	Latehar

Table - 2 :(Concltd.)

Name & address of producer	Location of mine	
	State	District
M. S. Singhanian, Jail Road, Daltonganj, Palamu, Jharkhand.	Jharkhand	Palamu
Sunandan Pradhan, Pradhan Industries, Telanga Bazar, Cuttack-9, Odisha.	Odisha	Rayagada
Natwar Lal Agarwal, P. O. Baalibabda, Dist.- Sambalpur, Odisha.	Odisha	Bolangir
Prabhas Chandra Agarwal, Shanti Kunj, Farm Road, Modipura, Sambalpur, Odisha.	Odisha	Bargarh, Bolangir

(Contd.)

**Table – 3 : Production of Graphite, 2007-08 to 2009-10
(By States)**

(Qty. in tonnes; value in Rs. '000)

State	2007-08		2008-09		2009-10(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	170813	75865	117767	46618	108606	44192
Jharkhand	14942	5622	14405	5267	28355	10699
Odisha	105328	45285	42925	21828	28532	12916
Tamil Nadu	50543	24958	60437	19523	51719	20577

**Table – 4 : Production of Graphite, 2008-09 and 2009-10
(By Sectors/States/Districts)**

(Qty. in tonnes; value in Rs. '000)

State/District	2008-09			2009-10(P)		
	No. of mines	Quantity	Value	No. of mines	Quantity	Value
India	35	117767	46618	30	108606	44192
Public sector	1	59227	18508	1	50764	19847
Private sector	34	58540	28020	29	57842	24345
Jharkhand	9	14405	5267	9	28355	10699
Palamu	8	14030	5147	8	23142	9005
Latehar	1	375	120	1	5213	1694
Odisha	24	42925	21828	19	28532	12916
Bargarh	5	1946	780	4	3576	1538
Bolangir	15	27350	15810	12	10632	6124
Nuapada	2	9407	3760	1	9633	3612
Rayagada	2	4222	1478	2	4691	1642
Tamil Nadu	2	60437	19523	2	51719	20577
Madurai	1	955	287	1	955	731
Sivaganga	1	59482	19236	1	50764	19846

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Table – 5 : Production of Graphite, 2008-09 & 2009-10(P)
(By Frequency Groups)

(Qty in tonnes)

Production Group	No. of mines		Production for the Group		Percentage In Total Production		Cumulative Percentage	
	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10
India	35	30	117767	108606	100	100	–	–
Up to 500	19	12	1988	934	2	1	2	1
501-1000	2	3	1576	2304	1	2	3	3
1001-2000	3	3	4849	4746	4	4	7	7
2001-3000	1	3	2745	6264	2	6	9	13
3001-4000	2	3	6633	9861	6	9	15	22
4001-5000	3	2	12511	9518	11	9	26	31
Above 5001	5	4	87465	74979	74	69	100	100

Table – 6 : Mine-head Stocks of Graphite, 2009-10(P)
(By States)

(Qty In tonnes)

State	At the beginning of the year	At the end of the year
India	45144	71345
Jharkhand	1306	6997
Odisha	12585	31174
Tamil Nadu	31253	33174

MINING & MARKETING

Graphite mines are mostly small and opencast barring a few underground mines. Water seepage beyond 6 m depth is the main problem faced by almost all mine owners in Odisha.

Active mining centres of graphite are in Latehar and Palamu districts in Jharkhand; Bargarh, Nuapada, Rayagada and Bolangir districts in Odisha and Madurai and Sivaganga districts in Tamil Nadu. In Jharkhand, mining activities are concentrated mostly around Sokara village in Palamu district. It is a disseminated deposit of flaky graphite containing 5 to 20% F.C. In Odisha, areas in and around Bolangir are the chief mining centres where several graphite grades are produced. At Bolangir, 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, analysing up to 40% F.C. in the past.

Dangachacha mine, also owned by TPMI, is a promising opencast mine in which the r.o.m. contains 40% F.C. The ore from the mine is partially beneficiated in a 3,000-tpy plant. The remaining output is sold to other beneficiation plants nearby. Graphite of Bolangir and Sambalpur districts is utilised mostly by the graphite crucible industry while graphite worked earlier from Kalahandi district used to be despatched to foundry units. The technological changes in recent years have considerably reduced the use of graphite as a lubricant. However, recycled graphite is being used in producing clay-bonded graphite crucibles.

BENEFICIATION

Graphite occurs generally admixed with the country rocks and hence, it often 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.

The r.o.m., on an average, containing 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. Few plant owners 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 Sivaganga area, Sivaganga district in Tamil Nadu. The beneficiation plant located adjacent to the mine site was commenced in November 1994 to produce 9,240 tpy of natural graphite concentrate containing 96% F.C. with 92% recovery from r.o.m. A list of important beneficiation plants in the country is given below:

Beneficiation Plants in India

Andhra Pradesh

Srinivasa Graphite Crucible Industries, P. O. Amadalavalsa, Srikakulam.

Jharkhand

Chhota Nagpur Graphite Industries, Daltonganj.

Carbon and Graphite Products, Daltonganj.

New Chemicals and Metals Products Private Ltd, Hazaribag Road, Ranchi.

Parijat Mining Industries (India) Private Ltd, Ranchi.
Carbon and Graphite Industries, Repala, Palamu.

Gujarat

Harikrupa Minerals, Chhota Udepur, Vadodara.

Farmsons Minerals Industries, Devgadbaria, Panchmahals.

India Minerals, Kellanpur, District Vadodara.

M. S. Patel, Muthai, Jatpur Road, Vadodara.

Odisha

Agrawal Graphite Industries, Sambalpur.

Gandhamardhan Graphite Udyog, Sambalpur.

G. R. Graphite Industries, Sambalpur.

National Carbon Products, Sambalpur.

Lakshminarayan Makhanlal Company, Sambalpur.

Graphite International, Sambalpur.

Laxminaryan Girdharilal, Sambalpur.

G. P. Minerals Industries, Sargipalli, Sambalpur.

T. P. Minerals Private Limited, Sambalpur.

Indesmin Graphite, Titlagarh.

Pioneer Graphite, Titlagarh.

Trinath Pradhan, Patnagarh, Bolangir.

B. K. Agrawal, Padmapur Diamond Graphite Industries, Kartabanji.

Raimata Graphite Industries, Patnagarh, Bolangir.

Misrilal Dharamchand Jain, Bolangir.

Pradhan Industries, Rayagada.

Mangalam Graphite Industries, Bhubaneswar.

Tamil Nadu

Tamil Nadu Minerals Ltd (TAMIN), Sivaganga.

SPECIFICATIONS

Traditional uses are in crucibles, foundries, pencils, etc. Now more sophisticated applications of graphite have emerged. Examples of such uses are in refractories, expanded graphite-based sealing, gasket, graphitised grease, braid, brushes, brake lining, etc. Graphite is used in bulk for producing certain products. It is also used in a minor amounts as a vital additive for producing other products. The specifications of graphite for some possible uses are as follows :

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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) alumina refractories	8-10	85% min	150-500
Clay-bonded crucibles	60-65	+80	-20 to +100 mesh.
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	Amorphous 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
Recarburisation of steel	100	99%	Micronised
Colloidal graphite	100	99.9%	Colloidal

Foundry coatings are used to prevent fusion of liquid metal with the sand at the mould or core face. They are applied as coating by spraying or painting in the form of suspension or by dusting or rubbing as dry powders. Good quality graphite which is one of the materials for this purpose, does not peel off in flakes. On drying, it imparts a smooth surface to the casting.

CONSUMPTION

Reliable 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 2007-08 to 2009-10 ranged from 14,100 tonnes to 14,700 tonnes. Out of total reported consumption in 2009-10, the refractory industry accounted for 6,900 tonnes (47%), crucible industry 4,600 tonnes (31%) and foundry industry 1,000 tonnes (7%). Industrywise consumption data are given in Table - 7.

Table - 7 : Reported Consumption of Graphite 2007-08 to 2009-10 (By Industries)

Industry	(In tonnes)		
	2007-08	2008-09(R)	2009-10(P)
All Industries	14100	14400	14700
Dry cell battery	400(2)	400(2)	400(2)
Electrode	600(5)	600(5)	600(5)
Foundry(e)+	1000(5)	1000(6)	1000(6)
Graphite products (Crucible)(e) ++	4600(3)	4600(3)	4600(3)
Graphite products (pencil)	500(1)	500(1)	500(1)
Refractory	6300(23)	6600(24)	6900(24)
Others (asbestos products, chemicals, paint, paper, pesticide, pharmaceuticals, and rubber)	700(20)	700(20)	700(20)

Figures rounded off. Data collected on non-statutory basis.

Figures in parentheses denote the number of units in organised sector reporting consumption.*

*(*Includes actual reported consumption and/or estimates made wherever required).*

(e)+ Estimated consumption taken from Market Survey conducted by IBM.

Excludes consumption of graphite for beneficiation purposes are estimated at 14,000 tonnes approximately.

(e)++ Based on the information supplied by The All India Graphite Crucible Manufacturers Association, Rajahmundry (A.P.) and field survey to Samalkot/ Rajahmundry area by Mineral Economics Division, IBM, in March, 2007.

WORLD REVIEW

The world inferred resources of graphite are believed to exceed 800 million tonnes of recoverable reserves. However, world reserves of graphite have been placed at 71 million tonnes of which China alone holds 55 million tonnes; i.e., over 77%, followed by India (7%) and Mexico (4%) (Table-8).

World production of graphite was 2.1 million tonnes in 2009. China continued to be the leading producer, having a share of about 83%, followed by India (5%) and Brazil (4%) (Table-9).

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

(In '000 tonnes)	
Country	Reserves
World : Total (rounded)	71000
Brazil	360
China	55000
Czech Republic	1300
India	5200
Madagascar	940
Mexico	3100
Other countries	5100

*Source: Mineral Commodity Summaries, 2010.
Canada, North Korea, Norway, Sri Lanka, Ukraine are included with 'Other countries.*

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

(In '000 tonnes)			
Country	2007	2008	2009
World : Total	2200	2400	2100
Brazil @	77	81	75
Canada	15	20	7 ^(e)
China #	1800	1800	1750 ^(e)
India *	171	132	107
Korea, Dem. P. R. of	30 ^(e)	30 ^(e)	30 ^(e)
Mexico	10	7	5
Russia	14 ^(e)	14 ^(e)	14 ^(e)
Ukraine	8 ^(e)	8 ^(e)	8 ^(e)
Zimbabwe	5 ^(e)	5 ^(e)	2 ^(e)
Other countries	70	303	102

*Source: World Mineral Production, 2005-09
@ Including beneficiated and directly shipped material.
Including flake graphite.
* Crude.*

FOREIGN TRADE

Exports

In 2009-10, exports of graphite (natural) decreased to 1,048 tonnes from 1,909 tonnes in the previous year. Graphite (natural) was exported mainly to UK (19%), UAE (11%) and Kenya (9%). Exports of graphite (artificial) decreased to 7,286 tonnes from 15,002 tonnes in 2009-10. Graphite (artificial) was exported mainly to Iran (47%), Bhutan (14%), USA (11%) and Germany (7%).

The exports of graphite crucibles decreased to 272 tonnes in 2009-10 from 681 tonnes in the previous year while exports of silicon carbide crucibles increased in 2009-10 to 6,903 tonnes from 5,651 tonnes in the previous year. Exports of graphite bricks and shapes were at 288 tonnes in 2009-10 compared to 216 tonnes in the previous year. Graphite bricks and shapes were mainly exported to Sudan, UK, Bangladesh and Iraq. Philippines, Nigeria and Syria were the main buyers of graphite crucibles. Silicon carbide crucibles were exported mainly to Iran, UK, Rep. of Korea, Turkey, USA, Spain and Germany (Tables - 10 to 14).

Imports

Imports of graphite (natural) increased to 12,780 tonnes in 2009-10 from 7,309 tonnes in the previous year. However, imports of graphite (artificial) decreased considerably to 13,422 tonnes in 2009-10 from 32,281 tonnes in the previous year. Graphite (natural) was mainly imported from China (89%). Imports of graphite (artificial) were mainly from China (58%), Norway (13%), and USA (8%). Imports of graphite bricks and shapes decreased sharply to 50 tonnes in 2009-10 from 594 tonnes in the previous year. Imports were mainly from China (80%). Imports of graphite crucibles dropped to 3,267 tonnes in 2009-10 from 6,072 tonnes in the preceding year. China was the main supplier with 95% share. Imports of silicon carbide crucibles decreased to 1,150 tonnes in 2009-10 from 2,607 tonnes in the previous year. Imports were mainly from Germany (27%), China (23%), UK (22%) and USA (14%) (Tables - 15 to 19).

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	1909	91887	1048	81374
UK	520	32667	203	22089
Ethopia	-	-	87	20768
France	91	9967	63	8878
Netherlands	51	7149	47	6714
UAE	36	1319	118	5746
Germany	368	25174	25	3215
New Zealand	22	715	11	2055
Malaysia	170	2233	1	87
Japan	72	2421	5	3139
Kenya	26	948	96	2527
Other countries	553	9294	392	6156

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	15002	941332	7286	373050
Iran	5772	150531	3461	86402
USA	490	48008	828	69701
Germany	3738	415833	501	64648
Bhutan	658	19633	1007	24129
Sweden	358	41858	58	16710
Australia	371	13303	218	13303
Japan	920	36032	87	6292
UK	954	40138	13	4281
Turkey	110	22652	6	1140
Indonesia	143	28456	1	486
Other countries	1488	124888	1106	85958

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	216	5467	288	2470
Iraq	-	-	25	1403
Sudan	-	-	132	561
UK	51	3155	82	273
Bangladesh	-	-	40	110
Oman	-	-	4	89
Nepal	20	346	4	24
USA	-	-	1	9
Argentina	50	310	-	-
Tanzania	53	384	-	-
UAE	42	1272	-	-
Other countries	-	-	++	1

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	681	21541	272	10831
Philippines	62	4809	58	3539
Nigeria	398	4595	36	2776
Syria	5	389	11	1064
Sri Lanka	26	1555	8	1012
Ecuador	-	-	6	805
Uganda	11	1590	2	30
Australia	20	2389	-	-
Bangladesh	108	2564	-	-
Belgium	19	598	-	-
Turkey	25	2878	-	-
Other countries	7	174	151	1605

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	5651	206577	6903	377106
Iran	1991	52535	1254	61263
Korea, Rep. of	149	7081	612	38426
Germany	203	20297	442	37307
Egypt	185	17870	397	28079
Indonesia	188	12569	233	23966
Turkey	92	11284	529	23562
South Africa	129	6341	403	21367
Spain	207	2340	429	20300
USA	34	3078	531	17444
UK	321	14297	811	16491
Other countries	2152	58885	1262	88901

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	7309	247346	12780	395701
China	5417	167680	11318	313333
Madagascar	380	15060	484	26092
Germany	169	18878	89	12926
Brazil	135	5813	202	9955
USA	176	6625	119	9209
Sri Lanka	461	10237	137	6445
Singapore	++	1	21	4551
Japan	13	1452	12	3901
UK	281	11123	116	3102
Sweden	148	6260	1	223
Other countries	129	4217	281	5964

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	32281	2080876	13422	1324733
China	25613	1135623	7839	371595
USA	1287	369817	1037	366920
Germany	631	91899	386	123634
Japan	294	118083	254	87222
France	540	90933	522	82670
Norway	2378	88584	1762	79674
Singapore	6	3506	390	71141
Netherlands	338	51306	358	47673
UK	299	61793	267	36994
Italy	247	16367	53	5392
Other countries	648	52965	554	51818

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	594	20649	50	1509
China	98	9703	40	1128
Germany	–	–	5	241
Japan	16	1320	4	82
South Africa	480	9626	–	–
Unspecified	–	–	1	58

GRAPHITE

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs. '000)	Qty (t)	Value (Rs. '000)
All Countries	6072	160680	3267	118418
China	5859	157670	3118	113537
USA	7	106	1	31
Germany	120	893	60	1069
Japan	12	241	2	41
France	73	1692	84	3714
Italy	1	77	1	25
UK	-	-	1	1
Other countries	++	1	-	-

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs. '000)	Qty (t)	Value (Rs. '000)
All Countries	2607	180490	1150	48859
UK	19	8004	258	15508
Germany	1344	7397	312	12475
China	100	2314	261	8736
USA	254	5958	158	5475
Italy	110	625	54	1815
Czech Republic	77	1943	60	1765
Japan	66	308	18	990
Brazil	60	6013	4	630
France	23	19149	6	321
Unspecified	373	128156	1	66
Other countries	1	123	18	1078

FUTURE OUTLOOK

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. Some important higher applications have emerged in exfoliated graphite which are for making sealings, gaskets, braids and brushes. New products of synthetic graphite are graphite fibres/ropes and graphite insulation blankets. Carbon-composite materials are used in very high technology areas, such as aerospace and these advanced materials are produced in Hyderabad in a pilot plant. On world scenario, a potential large-volume end-use for natural graphite has emerged in heat sinks, also called spreader shield, which is a graphite foil material conducting heat only in two directions. It has thermal conductivity above aluminium and almost equal to copper. These are used for carrying away heat in laptop computers, flat-panel displays, wireless phones, digital video cameras, etc. The silicon carbide crucible industry should be encouraged to increase the exports of its products for increased margin of profits.