

FIRECLAY



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FIRECLAY

(FINAL RELEASE)

**GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES**

Indira Bhavan, Civil Lines,
NAGPUR – 440 001

PHONE/FAX NO. (0712) 2565471
PBX : (0712) 2562649, 2560544, 2560648
E-MAIL : cme@ibm.gov.in
Website: www.ibm.gov.in

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20 Fireclay

The name fireclay is given to a group of refractory clays which can withstand temperatures above pyrometric cone equivalent (PCE) - 19. Refractoriness and plasticity are the two main properties needed in fireclay for its suitability in the manufacture of refractory bricks. A good fireclay should have a high fusion point (>1580°C) and good plasticity. Fireclay containing high alumina and low iron oxide, lime, magnesia & alkalies is preferred by refractory manufacturers. The aluminous (kaolinitic) variety of fireclay is more refractory because of its hardness and density and absence of iron, giving it a white-burning colour. The absence of alkalies gives it a very high fusion temperature.

RESERVES/RESOURCES

India possesses substantial reserves of fireclay. The best deposits occur in association with the coal seams in the Lower Gondwana Coalfields of Andhra Pradesh, Jharkhand, West Bengal, Madhya Pradesh and Neyveli lignite fields in Tamil Nadu. Notable occurrences of fireclay, not associated with coal measures, are reported in Gujarat, Jabalpur region of Madhya Pradesh and Belpahar-Sundergarh areas of Odisha. The reserves of fireclay are substantial but reserves of high-grade (non-plastic) fireclay containing more than 37% alumina are limited.

Reserves/resources of fireclay as per NMI data, based on UNFC system as on 1.4.2015 has been estimated at 722.83 million tonnes. Out of these, 27 million tonnes are grouped under reserves category while the bulk i.e. 695.79 million tonnes are classified under resources category. Out of 27 million tonnes reserves, 13.29 million tonnes are proved reserves and 13.74 million tonnes are probable reserves. Out of the total reserves/resources, Odisha accounts for 24% followed by Madhya Pradesh (18%), Tamil Nadu (16%), Jharkhand (9%), Gujarat & Rajasthan (8% each). Gradewise, refractory-plastic grade accounts for 37% followed by refractory-non-plastic/semi-plastic (16%) and refractory-unspecified (15%). The remaining 32% are of others, unclassified and not-known grades (Table-1).

EXPLORATION & DEVELOPMENT

No exploration was reported during the year 2015-16 by any Central/State govt. agencies.

PRODUCTION & STOCKS

As per GOI notification S.O.423 (E) dated 10th February 2015, fireclay has been declared as 'minor mineral'; hence, the production beyond January, 2015 is not available with IBM. List of producers of fireclay is furnished in Table - 2.

MINING AND MARKETING

Fireclay mines are worked by manual method. Most of the mines are small and worked by opencast method by forming benches in overburden and fireclay. Most of the refractory manufacturing units have their own captive mines.

The important marketing centres of fireclay are Bikaner in Rajasthan, Mahuamilan and Balumath in Jharkhand, Than in Gujarat, Katni in Madhya Pradesh and Belpahar in Odisha. Water seepage beyond the depth of 6 m is the main problem commonly faced by most of the mine owners and as a result of which most of the mines are kept closed during rainy season.

USES AND SPECIFICATIONS

Fireclays are used in the manufacture of cement, bricks, blocks, retorts, crucibles, mortars, masses, pottery, floor tiles, etc. Low-grade material is used for manufacturing heavy sanitaryware, such as, pipes and bath tubs. Firebricks are used where heat generation is involved. Firebricks are used extensively in furnaces, kilns and ovens. Firebricks are required chiefly by metallurgical industries.

The fireclays are graded into: i) low duty ii) intermediate duty iii) high duty and iv) super duty, depending upon their capacity to withstand high temperature before melting. The low duty fireclay can withstand temperatures between 1,515 and 1,615 °C (PCE 19-28); intermediate duty fireclay up to 1,650 °C (PCE 30), high duty fireclay up to 1,700 °C (PCE 32) and super duty beyond 1,775 °C (PCE 35).

BIS has not standardised any specifications for fireclay. However, the erstwhile Director General of Technical Development Sub-committee on Refractory Raw Materials had recommended specifications as given in Table-3.

**Table – 1 : Reserves/Resources of Fireclay 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			STD221	STD222						
All India : Total	13295	5035	8707	27037	13878	30155	18260	49290	54093	524011	6104	695791	722829
By Grades													
Refractory-non-plastic/semi-plastic	2069	782	813	3663	4099	15234	3231	2607	1397	86980	-	113548	117211
Refractory-plastic	2271	1113	2076	5460	2492	4835	3074	4076	4674	238564	5146	262861	268321
Refractory-unspecified	7493	2088	4666	14248	5552	5983	6625	945	2010	69444	-	90558	104806
Others	641	302	772	1715	1384	2394	3420	7251	4137	44935	125	63647	65362
Unclassified	821	749	381	1951	194	1382	823	205	30	10020	-	12653	14604
Not-known	-	-	-	-	157	327	1087	34206	41845	74070	833	152525	152525
By States													
Andhra Pradesh	1252	40	642	1934	771	1400	1574	56	417	10211	132	14562	16496
Assam	-	-	-	-	-	-	-	-	-	3161	-	3161	3161
Bihar	-	-	-	-	-	-	-	-	-	44	-	44	44
Chhattisgarh	315	23	94	433	68	27	17	7180	3400	10435	-	21126	21558
Delhi	-	-	-	-	-	-	-	6	13	45	-	64	64
Gujarat	231	-	56	287	1193	664	966	2120	1053	53526	-	59522	59809
Jammu & Kashmir	-	-	-	-	-	-	-	-	-	-	4914	4914	4914
Jharkhand	-	-	3	3	-	1125	309	139	122	64755	-	66450	66454
Karnataka	146	-	-	146	247	340	2003	-	226	8832	-	11648	11794
Kerala	-	-	-	-	-	-	-	8200	51	9929	-	18181	18181
Madhya Pradesh	390	4192	3020	7603	2139	7164	4975	1551	2129	100977	100	119036	126639
Maharashtra	-	322	388	709	17	44	32	-	-	6652	-	6746	7455
Meghalaya	-	-	-	-	-	-	-	-	-	10999	-	10999	10999
Odisha	133	-	40	173	3074	12376	4495	26219	42925	83662	-	172751	172924
Rajasthan	6561	-	3932	10493	1548	1718	697	2256	2580	35363	-	44163	54656
Tamil Nadu	2523	458	155	3136	3952	3971	1842	1561	-	102202	-	113528	116663
Telangana	762	-	-	762	667	746	-	-	758	8514	-	10684	11446
Tripura	-	-	-	-	-	-	-	1	-	369	-	370	370
Uttar Pradesh	-	-	-	-	-	-	-	-	-	3221	-	3221	3221
West Bengal	981	-	377	1359	201	580	1349	-	419	11114	958	14622	15981

Figures rounded off.

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Table – 2 : Principal Producers of Fireclay

Name & address of producer	Location of mine	
	State	District
Sampat Lal Daga, Labuji Ka Katla, 1 st Floor, Bagree Mohalla, Bikaner- 334 001, Rajasthan.	Rajasthan	Bikaner
Maheshbhai Nanalal Bharad, Darbargadh Street, Thangadh, Chotila-363 530, Gujarat.	Gujarat	Rajkot
A. Abdullah, No.10/108, North Street, T. Pottakollai.Z.Thathanur, Udayarpalayam- 621 804, Dist. Ariyalur, Tamil Nadu.	Tamil Nadu	Ariyalur

(Contd.)

The Expert Group on Classification of Minerals with regard to their Possible Optimum Industrial Use had recommended the following end-use classification of fireclay for Refractory Industry:

Type	Constituent		
	Al ₂ O ₃	Fe ₂ O ₃	PCE (orton)
Non-plastic/ semi-plastic	30% (min)	2% (max)	30 (min)
Plastic	18% (min)	3% (max)	18 (min)

Crude fireclay and other clays including kaolin (china clay) are also used in a few cement manufacturing plants to increase the alumina content in the raw meal and its plasticity.

Table-2 (Concl.)

Name & address of producer	Location of mine	
	State	District
Bikaner Ceramics (P) Ltd, Industrial Area, Rani Bazar- 334 001, Rajasthan.	Rajasthan	Bikaner
Firoz Musabhai Kaladiya, C/o Musabhai Ismailbhai, Kaladia, PO.Chotila, Fulwadi, Thangadh Road, Surendranagar-363 530, Gujarat.	Gujarat	Surendranagar
Ramjibhai Chunilal Kanjaria, Near Vasuki Temple, Thangadh, Chotila- 363 530, Gujarat.	Gujarat	Surendranagar
Sunder Lal Daga, Bagree Mohalla, Bikaner- 334 001, Rajasthan.	Rajasthan	Bikaner

Table – 3 : Specifications of Plastic and Non-plastic Fireclays

Grade	Constituent		
	Al ₂ O ₃	Fe ₂ O ₃	PCE (orton)
i) Non-plastic/Semi-plastic Fireclay			
Grade-I	35-40%	1.0% max	33 min
Grade-II	32-35%	1.0-1.5% max	32 min
Grade-III	30-32%	1.5-2.0% max	30 min
ii) Plastic Fireclay			
Grade-I	30-32%	1.0-1.5%	30 min
Grade-II	28-30%	2.0-3.0%	28 min
Grade-III	22-28%	1.0-2.0%	26 min
Grade-IV	18-20%	1.5-2.0%	18-21 min

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CONSUMPTION

The total consumption of fireclay increased from 446,300 tonnes in 2014-15 to 681,000 tonnes in 2015-16. Cement Industry was the major consumer of crude fireclay accounting for about 64% consumption in 2015-16, followed by refractory (27%), ceramic (6.5%) and iron & steel (1.5%) industries. About 1% was consumed in other industries, i.e. pesticide, alloy steel, graphite products, foundry, sugar, etc. (Table-4).

**Table- 4: Consumption* of Fireclay
2013-14 to 2015-16
(By Industries)**

Industry	(In tonnes)		
	2013-14	2014-15 (R)	2015-16 (P)
All Industries	529700	446300	681000
Alloy steel	500	500	500
Cement	293500	205200	435400
Ceramic	44200	44900	44100
Foundry	200	200	200
Graphite products	1300	1300	1300
Iron & steel	10500	10500	10500
Pesticides	2900	2900	2900
Refractory	176400	180600	185900
Sugar	100	100	100
Others (abrasive, glass, paper, textile, and vanaspati)	100	100	100

Figures rounded off.

**Includes actual reported consumption and /or estimates made wherever required and due to paucity of data, coverage may not be complete.*

FOREIGN TRADE

Exports

The exports of fireclay drastically decreased to 887 tonnes in 2015-16 from 2,503 tonnes in 2014-15. Exports were mainly to Nepal & UAE (29% each), Bangladesh (13%), Angola (9%) and Gabon (7%). Exports of refractory bricks decreased to 192 thousand tonnes in 2015-16 from 234 thousand tonnes in 2014-15. Exports were mainly to Ukraine (9%), UAE (6%), Bangladesh & U.K. (5% each) and France & Turkey (2% each) (Tables-5 & 6).

Imports

Imports of fireclay in 2015-16 increased drastically to 393 tonnes from meagerly 4 tonnes in the previous year. Imports were mainly from Saudi

Arabia (56%) followed by China (16%), U.K. (13%) and Korea (10%). Imports of refractory bricks marginally decreased to 250 thousand tonnes in 2015-16 from 287 thousand tonnes in the previous year. The share of imports from China was 79% which was followed by Germany (12%), USA & Austria (2% each) (Tables - 7 & 8).

**Table- 5: Exports of Fireclay
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	2503	16318	887	10774
UAE	326	4898	255	4852
Nepal	250	1145	261	1847
Bangladesh	945	2808	112	1317
Angola	115	497	77	403
Kenya	43	657	34	368
USA	2	74	1	356
Mauritius	24	422	3	296
Gabon	72	310	62	286
Thailand	-	-	2	243
Saudi Arabia	8	162	22	161
Other countries	718	5345	58	645

**Table - 6 : Exports of Refractory Bricks
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	234488	7377431	191826	8079745
Ukraine	11	2607	17213	562560
Turkey	3538	455647	3358	442932
France	2026	280093	3455	423223
Russia	1266	186336	2124	337137
Korea, Rep. of	1856	201272	1903	315188
Mexico	2203	109517	2839	300350
Bangladesh	4201	128605	9922	282824
UK	9666	291727	9383	281898
UAE	60631	201024	12374	281651
USA	8130	591593	1562	276436
Other countries	140960	4929010	127693	4575546

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**Table- 7: Imports of Fireclay
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	4	137	393	16839
Saudi Arabia	-	-	222	10974
Korea, Rep. of	-	-	40	2877
China	4	83	64	1232
UK	-	-	50	585
USA	++	49	10	489
Bangladesh	-	-	++	432
Thailand	++	5	7	246
Russia	-	-	++	4

**Table – 8 : Imports of Refractory Bricks
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	286989	18671318	249639	14151754
China	246238	13451819	197016	9389193
Germany	16665	1638616	30867	1630002
USA	5809	1535457	3929	1294224
Austria	5579	516795	4424	384197
France	921	140681	2709	354826
Belgium	1189	464917	1031	307672
Turkey	1059	81513	3076	182848
Japan	536	83296	487	97428
UK	271	47000	542	79539
Korea, Rep. of	330	19396	956	75643
Other countries	8392	691828	4602	356182

FUTURE OUTLOOK

Fireclay is one of the most important minerals used in the Refractory Industry. Cement Industries were the major consumer of crude fireclay accounting for about 64% consumption in the year 2015-16. India has huge reserves of fireclay and there does not seem to be any problem in respect of supplies to the Refractory Industry in the near future. However, a serious dearth is being felt in the availability of high-grade fireclay analysing 37% and above Al_2O_3 with Fe_2O_3 and fluxing impurities less than 2% for supply to the refractories.

To fulfil the increasing demand of the Refractory Industry, it is imperative that deposits of high-grade fireclay be explored and delineated.

The export prospect of fireclay is relatively less as it is considered as low-value high bulk mineral. However, fireclay bricks as a commodity could have high export potential and therefore must be encouraged.

As per the Sub-Group-II Report for 12th five year plan, the apparent domestic demand of fireclay was estimated at 739 thousand tonnes by 2016-17 at 9% growth rate.