

79 Wollastonite

Wollastonite, a metasilicate of calcium (CaSiO_3), contains theoretically 48.3% CaO and 51.7% SiO_2 . It occurs as aggregates of bladed or needle-like crystals. Ceramic industry uses substantially, domestic production of wollastonite, as a filler. Some other uses of wollastonite are as a filler in ceramic floor and wall tiles, marine wallboard, paint, plastic and in refractory liners in steel mills, and as a partial replacement for short-fibre asbestos in certain applications, such as brake-lining. Technical improvements in filler properties in plastic and rubber have been made in recent years. A better compatibility between the polymer and the filler is achieved by chemical surface treatment of the mineral filler. Wollastonite, when treated in such a manner, results in improved flexural modules in polypropylene and improved reinforcement in nylon.

RESOURCES

Major deposits of wollastonite have been found in Sirohi, Udaipur and Dungarpur districts in Rajasthan. Besides, in Ghoda area, Banaskantha district in Gujarat and in Dharmapuri and Tirunelveli districts in Tamil Nadu, a few deposits occur. As on 1.4.2005, the resources of wollastonite, as per UNFC system are placed at 20.2 million tonnes. Out of total resources, about 90% (18.2 million tonnes) including 8.5 million tonnes reserves are located in Rajasthan and the remaining about 10% reserves (1.99 million tonnes) in Gujarat. Meagre resources are located in Tamil Nadu (3,533 tonnes) (Table-1).

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

(In tonnes)

| Grade/State | Reserves | | | Remaining resources | | | | | Total resources (A+B) |
|--------------------------|----------------|-----------------|----------------|---------------------|------------------------|------------------|-----------------|-----------------|-----------------------|
| | Proved STD111 | Probable STD122 | Total A | Feasibility STD211 | Pre-feasibility STD222 | Indicated STD332 | Inferred STD333 | Total B | |
| All India : Total | 7423894 | 1109417 | 8533311 | 372866 | 3836224 | 3325042 | 4174180 | 11708312 | 20241623 |
| By Grades | | | | | | | | | |
| Marketable | 3326899 | 1109417 | 4436316 | 372866 | 3836224 | - | 2050770 | 6259860 | 10696176 |
| Unclassified | 4096995 | - | 4096995 | - | - | 3325042 | 2044800 | 5369842 | 9466837 |
| Not known | - | - | - | - | - | - | 78610 | 78610 | 78610 |
| By States | | | | | | | | | |
| Gujarat | - | - | - | - | - | - | 1990000 | 1990000 | 1990000 |
| Rajasthan | 7423894 | 1109417 | 8533311 | 372866 | 3836224 | 3325042 | 2180647 | 9714779 | 18248090 |
| Tamil Nadu | - | - | - | - | - | - | 3533 | 3533 | 3533 |

Figures rounded off.

EXPLORATION & DEVELOPMENT

During 2007-08, the Directorate of Mines and Geology, Govt. of Rajasthan, carried out prospecting for wollastonite-bearing skarn zones in Jaipur and Sikar districts. Near village Kaliba ki Dhani,

Sudarpura, Jimgaur, etc, tehsil Kotputli in Jaipur district and Rajpura-Dhandhela, tehsil- Neem ka Thana in Sikar district, mapping in the scales 1:10,000 and 1:2,000 was carried out. Wollastonite-bearing skarn zones of varying dimensions were identified.

WOLLASTONITE

PRODUCTION, STOCKS & PRICES

Production of wollastonite at 119 thousand tonnes in 2007-08 registered decrease of 10 % as compared to that in the preceding year due to low demand in the market. There were 2 reporting mines during 2007-08. The entire output was reported from private sector mines located in Rajasthan (Tables - 2 to 4).

Mine-head stocks at the end of the year 2007-08 were 198 tonnes as against 183 tonnes at the beginning of the year (Table - 5).

The average daily employment of labour during 2007-08 was 488 as against 631 in the previous year. Domestic prices of wollastonite are furnished in Table - 6.

Table – 2 : Principal Producer of Wollastonite 2007-08

| Name & address of producer | Location of mine | |
|--|------------------|-----------------------|
| | State | District |
| Wolkem Industries Ltd, Sulumber House, Ambavgarh, Distt. Udaipur – 313 004, Rajasthan. | Rajasthan | Sirohi and Udaipur |

**Table - 5 : Mine-head Stocks of Wollastonite 2007-08 (p)
(By State)**

| State | (In tonnes) | |
|--------------|------------------------------|------------------------|
| | At the beginning of the year | At the end of the year |
| India | 183 | 198 |
| Rajasthan | 183 | 198 |

**Table – 3 : Production of Wollastonite, 2005-06 to 2007-08
(By State)**

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

| State | 2005-06 | | 2006-07 | | 2007-08 (p) | |
|--------------|---------------|--------------|---------------|---------------|---------------|---------------|
| | Quantity | Value | Quantity | Value | Quantity | Value |
| India | 128582 | 99294 | 131572 | 114086 | 118666 | 101938 |
| Rajasthan | 128582 | 99294 | 131572 | 114086 | 118666 | 101938 |

**Table – 4 : Production of Wollastonite, 2006-07 and 2007-08
(By Sector/State/District)**

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

| State/District | 2006-07 | | | 2007-08 (P) | | |
|----------------|--------------|---------------|---------------|--------------|---------------|---------------|
| | No. of mines | Quantity | Value | No. of mines | Quantity | Value |
| India | 2 | 131572 | 114086 | 2 | 118666 | 101938 |
| Private sector | 2 | 131572 | 114086 | 2 | 118666 | 101938 |
| Rajasthan | 2 | 131572 | 114086 | 2 | 118666 | 101938 |
| Sirohi | 1 | 54234 | 49895 | 1 | 54906 | 51886 |
| Udaipur | 1 | 77338 | 64191 | 1 | 63760 | 50052 |

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**Table – 6 : Prices of Wollastonite, 2005-06 to 2007-08
(Domestic Markets)**

(In Rs. per tonne)

| Grade | Market | 2005-06 | 2006-07 | 2007-08(p) |
|--------------|--------------------------------|---------|---------|------------|
| ROM | Ex-mine Belka (Rajasthan) | 856 | 920 | 945 |
| ROM | Ex-mine Kheratarla (Rajasthan) | 590 | 690 | 715 |
| Reject Grade | Ex-mine Kheratarla (Rajasthan) | 470 | 470 | 495 |
| M-4 Grade | Ex-mine Khera (Rajasthan) | 763 | 830 | 830 |
| Low Grade | Ex-mine Udaipur (Rajasthan) | 350 | 350 | 350 |

MINING, PROCESSING & MARKETING

Wollastonite is being mined by opencast semi-mechanised method in Sirohi district, Rajasthan. The run-of-mine is selectively hand-sorted to the size 30 cm to 50 cm to remove the associated minerals, such as calcite, diopside, garnet, quartz and iron. Wollastonite, thus separated, is then crushed to various sizes at two crushing plants near Sirohi railway station, having a total capacity of 80,000 tpy by Wolkem Industries Ltd, to produce four principal commercial grades; viz, Kemolit M-3-300 mesh, Kemolit M-2-200 mesh, Kemolit M-1-100 mesh and Kemolit MF-160 mesh. The company claimed minus 160 mesh fibrous powder as an effective substitute for asbestos. Wolkem Industries Ltd, a wollastonite mining and processing company, meets 20% of global requirements. Investigations carried out on a sample sent by the party at Central Building Research Institute (CBRI) revealed that it could substitute chrysotile asbestos to a little extent in the manufacture of cement products. The Belkapahar deposit, Sirohi district, Rajasthan, produces wollastonite of the following grades:

| Constituent | Grade-I | Grade-II | Grade-III |
|--------------------------------|---------|----------|-----------|
| CaO | 48.16% | 47.62% | 46.20% |
| SiO ₂ | 46.12% | 47.42% | 48.00% |
| Al ₂ O ₃ | 0.23% | 0.60% | 0.76% |
| Fe ₂ O ₃ | 0.49% | 0.40% | 0.44% |
| MgO | 0.20% | 0.40% | 0.30% |
| L.O.I. | 1.51% | 2.37% | 2.71% |

USES & SPECIFICATIONS

The use of wollastonite depends on the accicularity or the aspect ratio; i.e., ratio between length and width of a crystal. Wollastonite having aspect ratio in the range from 3:1 to 5:1 has little potential for reinforcing applications and hence, market is primarily confined to ceramic, metallurgical fluxes and simple filler and coating applications. Wollastonite with aspect ratio in the range from 15:1 to 20:1 is considered as a semi-fibrous. It can be used as replacement for asbestos and thus finds high potential growth as a performance filler for strengthening various plastic and resin systems of daily use. It reduces the volume of the expensive plastic or resin medium and contributes to physical and chemical properties of the finished products.

The whiteness of the mineral, low loss on ignition (L.O.I.), higher compressive and transverse strength values are important for its use in filler, coating and ceramic applications. The low thermal expansion of wollastonite reduces shrinkage and other dimensional instabilities and glaze defects. However, removal of associated calcite is necessary to avoid carbon dioxide generation during melting.

Bulk demand for wollastonite in the country is in the ceramic industry for the manufacture of floor and wall tiles, while small quantities are used in asbestos-cement products, paint, insecticide and welding rod industries. The ceramic industry uses generally wollastonite analysing CaO 47%, SiO₂ 45%, Fe₂O₃ 1.5% (max) and L.O.I. 3 to 4 percent. Because of absence of alkalis, it is highly suitable for ultralow-loss insulator and in ultrahigh frequency electric equipment, such as high temperature porcelain (spark plugs and H.T. circuit breakers, etc.).

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CONSUMPTION

The reported consumption of wollastonite is estimated at 4,500 tonnes in 2007-08. The ceramic industry consumed almost the entire quantity of wollastonite (Table - 7).

Table - 7: Reported Consumption of Wollastonite 2005-06 to 2007-08 (By Industries)

| (In tonnes) | | | |
|-----------------------|-------------|-------------|-------------|
| Industry | 2005-06(R) | 2006-07 | 2007-08(p) |
| All Industries | 4500 | 4500 | 4500 |
| Asbestos products | ++ (3) | ++ (4) | ++ (3) |
| Ceramic | 4500(16) | 4500(16) | 4500(16) |

Figures rounded off. Data collected on non-statutory basis. Figures in parentheses denote the number of units in organised sector reporting consumption.

WORLD REVIEW

The countrywise production of wollastonite in 2005 to 2007 is furnished in Table - 8. India is meeting 20% of the global requirement. As per available data, China was the largest producer, followed by India and the USA.

Table - 8: World Production of Wollastonite (By Principal Countries)

| (In tonnes) | | | |
|--------------------|--------|--------|---------------------|
| Country | 2005 | 2006 | 2007 |
| China | 350000 | 350000 | 350000 ^e |
| Finland | 15950 | 16200 | 16364 |
| India | 128582 | 131572 | 118666 |
| Mexico | 27132 | 44280 | 50809 |
| Namibia | 253 | 55 | 60 ^e |
| USA ^(e) | 120000 | 125000 | 125000 |

Source: World Mineral Production, 2003-2007.

FOREIGN TRADE

In 2007-08, exports of wollastonite increased to 23,643 tonnes from 17,760 tonnes in the previous year. Exports were mainly to Belgium (53%), Japan (15%), Germany (11%), Netherlands (9%) and Italy (4%). Imports of wollastonite also increased in 2007-08 to 153 tonnes from 97 tonnes in the previous year. imports were mainly from China (Tables - 9 and 10).

Table - 9: Exports of Wollastonite (By Countries)

| Country | 2006-07 | | 2007-08 | |
|----------------------|--------------|------------------|--------------|------------------|
| | Qty. (t) | Value (Rs. '000) | Qty. (t) | Value (Rs. '000) |
| All Countries | 17760 | 166933 | 23643 | 211450 |
| Belgium | 10730 | 97029 | 12635 | 113546 |
| Germany | 1744 | 24645 | 2507 | 30887 |
| Japan | 1370 | 9836 | 3565 | 23854 |
| Netherlands | 602 | 4664 | 2100 | 16779 |
| Italy | 510 | 3843 | 847 | 6476 |
| UK | 1372 | 13893 | 538 | 5462 |
| USA | 573 | 4507 | 503 | 4093 |
| Australia | 371 | 3559 | 315 | 3043 |
| Saudi Arabia | 114 | 1483 | 220 | 3023 |
| Canada | 103 | 744 | 143 | 930 |
| Other countries | 271 | 2730 | 270 | 3357 |

Table - 10: Imports of Wollastonite (By Countries)

| Country | 2006-07 | | 2007-08 | |
|----------------------|-----------|------------------|------------|------------------|
| | Qty. (t) | Value (Rs. '000) | Qty. (t) | Value (Rs. '000) |
| All Countries | 97 | 1283 | 153 | 2363 |
| China | 43 | 296 | 116 | 768 |
| Germany | - | - | 4 | 452 |
| USA | 5 | 179 | 7 | 427 |
| Italy | 20 | 255 | 20 | 357 |
| Mexico | 2 | 269 | 5 | 307 |
| Netherlands | - | - | 1 | 36 |
| Japan | ++ | 11 | ++ | 16 |
| Spain | 6 | 84 | - | - |
| UAE | 21 | 189 | - | - |

FUTURE OUTLOOK

Presently, India is world's third largest producer of wollastonite after China and USA. The existing mines in the country are in a position to meet the domestic requirements of the ceramic industry as well as export demand. There is an increasing demand for wollastonite in the international markets, especially in ceramic and plastic industries and in construction activities.