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MINOR MINERALS

30.16 MICA

(FINAL RELEASE)

GOVERNMENT OF INDIA
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30-16 Mica

Mica is widely distributed and occurs in igneous, metamorphic and sedimentary regimes. Mica group represents 34 phyllosilicate minerals that exhibits a layered or platy structure. Commercially important mica minerals are muscovite (potash or white mica) and phlogopite (magnesium or amber mica). Granitic pegmatites are the source of muscovite sheet, while phlogopite is found in areas of metamorphosed sedimentary rocks into which pegmatite rich granite rocks have been intruded. It possesses highly perfect basal cleavage due to which it can easily and accurately split into very thin sheets or films of any specified thickness. It has a unique combination of elasticity, toughness, flexibility and transparency. It possesses resistance to heat and sudden change in temperature and high dielectric strength. It is chemically inert, stable and does not absorb water.

For over hundred years, India has enjoyed the monopoly in the production and export of sheet mica in the world. Of late, there has been a steady downfall in the production of mica. This declining trend could be attributed to fall in the demand of natural mica in the world market due to technological improvements that facilitate use of reconstituted mica and emergence of mica substitutes. However, there are sufficient resources in the country to meet the domestic requirement and export demand.

RESERVES/RESOURCES

Most important mica-bearing pegmatites occur in Andhra Pradesh, Bihar, Jharkhand, Maharashtra, Odisha, Rajasthan and Telangana. Occurrences of mica pegmatites are also reported from Gujarat, Haryana, Karnataka, Kerala, Tamil Nadu and West Bengal.

As per NMI database based on UNFC system, the total reserves/resources of mica in the country as on 1.4.2015 have been estimated at 635,302 tonnes out of which 114,433 tonnes are placed under Reserves category and 520,869 tonnes under Remaining Resources category. Andhra Pradesh leads with 41% share in country's total resources followed by Rajasthan (28%), Odisha (17%), Maharashtra (13%), Bihar (2%) and a small quantity of resources is found in Jharkhand and Telangana (Table- 1).

PRODUCTION

Mica (Crude)

As per Govt. of India Notification S.O. 423(E), dated 10th February 2015, 'mica' has been declared as 'Minor Mineral' hence, the production data is not available with IBM.

MINING, MARKETING AND TRANSPORT

All the mica mines were first opened as prospecting pits. These trial workings were later developed into opencast workings of 5 to 10 m depths known as Upper Challa. The nature & quality of the yield decides as to whether underground method has to be adopted for mining of mica, especially mica-bearing pegmatites. Overhand cut-and-fill method of mining with flat-back and waste-fill methods are practised in mica mines. Pegmatite deposits are opened up by striking vertical or inclined shaft. As mica is confined to hanging wall and footwall contacts and sometimes to core zone, driving and stoping are done only in these areas. The entire pegmatite body is not subjected to stoping, and wall and roof are generally self-supporting. The mines are developed to maximum 100 m depths. Most of the mines have installed haulages for transport of material, electric fans for ventilation and pumps for dewatering.

Table – 1 : Reserves/Resources of Mica as on 1.4.2015
(By Grade/States)

(In kg)

Grade/State	Reserves				Remaining Resources								Total Resources (A+B)
	Proved STD111	Probable STD121	Probable STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221	Pre-feasibility STD222	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
All India : Total	**82187635**	**20035595**	**12209547**	**114432777**	**38252500**	**10605400**	**124089303**	**143353477**	**56528016**	**144446953**	**3593715**	**520869364**	**635302141**
By Grade													
Unclassified	82187635	20035595	12209547	114432777	38252500	10605400	124089303	143353477	56528016	144446953	3593715	520869364	635302141
By States													
Andhra Pradesh	61942537	18293548	-	80236085	18960000	-	-	93830994	12894000	51668132	-	177353126	257589211
Bihar	-	-	-	-	-	-	-	-	-	13066667	7700	13074367	13074367
Jharkhand	-	-	-	-	-	-	-	-	-	1494430	170700	1665130	1665130
Maharashtra	-	-	-	-	-	-	65916000	-	-	15120000	-	81036000	81036000
Odisha	-	-	-	-	-	-	51856000	-	26712000	26712000	-	105280000	105280000
Rajasthan	20245098	1742047	12209547	34196692	19292500	10605400	5732418	49522483	16922016	36385724	3415315	141875856	176072548
Telangana	-	-	-	-	-	-	584885	-	-	-	-	584885	584885

Figures rounded off

The old method was tunneling, which has now in some of the old mines been converted into open quarries. With this system, mines now produce felspar, quartz, mica and vermiculite. This system has also enabled use of heavy machinery which resulted in increased production.

Crude mica produced from the workings is transported to the surface where it is cobbled manually to remove the gangue minerals like quartz, felspar and other associated minerals, including waste mica. Skilled labourers dress the hand-cobbled mica with sickle, knife and scissors. During dressing, the part of mica containing deformities, such as, fractures, unevenness and cracks is removed and only the better material is retained as blocks. Such blocks are classified into various sizes and qualities on the basis of visual estimates. The mica so rejected during dressing is sold as scrap. Mica processing is a labour-intensive activity requiring special skills. The art of manual processing of mica has been acquired by the Indian workers through generations and has become a cottage industry in the mica mining areas of Bihar, Andhra Pradesh, Jharkhand and Rajasthan.

USES

Natural sheet mica is used in Electrical and Electronic industries in the form of blocks, splittings and films or built-up mica called “micanite". Sheet mica is used in manufacturing fabricated and micanite products, such as, capacitors and commutator segments. Micanite or built-up mica is partly overlapped, irregular-shaped and arranged as splittings cemented together with either an organic or inorganic binder. Other uses of sheet mica include gauge glasses of high pressure steam boilers, diaphragms of oxygen-breathing equipment, marker dials of navigation compasses, quarterwave plates for optical instruments, window covers for radiation pyrometers & thermal regulators, stove window, chimneys for gas & petromax lamps, diaphragms in microwave transmitters and insulation wrappers for high tension radar coils. Besides, high quality natural mica sheets are used in helium-neon lasers where mica sheet works as retardation plate. Of late, mica washers are extensively used in Computer Industry.

Mica paper or reconstituted mica is a paper-like material made by depositing fine flakes of scrap mica as a continuous mat which is then dried. Mica paper is usually impregnated with organic binder. Primary end-uses of mica paper are the same as for micanite or built-up mica.

Micanite is used in electrical insulation mainly because natural mica sheet of sufficient thickness is not always available. This is used in copper commutator segments of DC universal motors and generators, moulding plates from which V-rings are cut and stripped for use in commutators. These moulding plates also find use in the form of tubes and rings as an insulator in transformers, armatures and motor starters. As flexible plates, micanite is also used in electric motors and generator-armatures, field coil insulators & magnet and commutator core insulation. Similarly, as heater plates, micanite is used where high insulation strength at high temperature is required.

In the Construction Sector, mica scrap/ground mica is used in jointing cement for gypsum boards, asphaltic roofings and damp-proof seal, and insulation boards. Ground mica acts as reinforcing filler in plaster for textured coatings. Mica is used in insulation bricks, slabs and tiles because of its excellent thermal and insulating properties. Dry-ground 50 mesh mica is used in the flux coating for arc welding electrodes, with flux containing 3 to 5% mica powder. In paints, mica in the form of powder is used as filler and as an extender because it provides a smoother consistency, improved workability and imparts increased resistance to water penetration and weathering. It also facilitates suspension due to its relatively low specific gravity and platy morphology. Mica is used mainly in four types of paints, such as, bituminous emulsions, exterior paints, fire-retardant paints and pearlescent pigments. Mica is added to drilling fluids to get off the lost circulation zones. The platy structure of mica facilitates the overlapping of particles to form a tight layer or wall, thereby preventing further fluid loss.

Ground mica is used in the Rubber Industry as a dusting agent and as an inert filler in the production of rubber. Mica fillers increase the

hardness, tensile strength and tear resistance of rubber articles. In Plastic Industry, mica is used as a filler and reinforcer in thermoplastics to improve the electrical properties, flexural strength & modulus, stiffness, heat deflection temperatures and resistance. Dry-ground mica powder is used in small quantities in cosmetic applications. The property of high resistance of mica to the effect of the sun rays, moisture, gases, water and other chemicals, enables the use of dry-ground mica powder in small quantity to improve the decorative coating and lustre of wallpaper, printing and ceiling papers, etc. Wet-ground mica powder is used in paints, cosmetics, rubber, etc. as a filler. Small quantities of scrap mica/ ground mica are also used in industries like foundries as coating to foundry cores and moulds, as a dry lubricant to prevent hot bearings from seizing up.

SUBSTITUTES

Mica and its products can be substituted to some extent by using alumina, ceramics, bentonite, glass, mylar polystyrene, fused quartz, silicon, talc, bakelite, teflon, nylon synthetic mica, acrylate polymers, cellulose acetate, fibre glass, etc.

Some lightweight aggregates, such as, diatomite, vermiculite and perlite may be substituted for ground mica when used as filler. Ground synthetic fluorophlogopite, fluorine-rich mica, may replace natural ground mica for uses that require thermal and electrical properties of mica.

Sheet mica is used in electrical components, electronics and atomic force microscopy. Many products can be substituted for mica in electrical and electronic uses. Substitutes include Acrylic, Benelex, Cellulose acetate, Delrin, Duranel N, Fibreglass, Fishpaper, Kel F, Kydex, Kapton Lexan, Lucite, Mylar, Nylon, Nylatron, Nomex, Noryl, Phenolics, Plexiglass, Polycarbonate, Polyester, Styrene, Teflon, Vinyl-PVC and Vulcanised Fibre.

SPECIFICATIONS

The Bureau of Indian Standards (BIS) has prepared standards for (a) processed mica, (b) fabricated mica and (c) mica-based products. BIS has brought out the following specifications for mica for various purposes:

IS:1175 – 1981(First Revision, Reaffirmed 2011): Deals with methods of grading and classification of muscovite mica blocks, thins and films according to visual size, visual qualities and presence of structural imperfections.

IS:1885 (Part-53)-1980 (Reaffirmed 2007): Deals with electrotechnical vocabulary, Part-53, Mica.

IS:2001-1968: Deals with specifications of fixed silvered mica capacitors.

IS:2464-1963 (Reaffirmed 2008): Deals with specifications of built-up mica for electrical purposes.

IS:9043-1979 (Reaffirmed 2011): Deals with grading (by size) of phlogopite mica blocks, thins, films and splittings.

IS:9044-1979 (Reaffirmed 2011): Deals with methods of measuring thickness of mica blocks, thins, films and splittings.

IS:9045-1979 (Reaffirmed 2011): Deals with thermal classification of phlogopite mica splittings.

IS :9299 (Part 3/Sec.1)- 1979 (Reaffirmed 2003): Deals with rigid mica material for commutator separators.

IS:9299 (Part3/Sec.2)–1982 (Reaffirmed 2003): Deals with moulding mica materials for electrical purposes.

IS:9299 (Part 3/Sec. 3) – 1982 (Reaffirmed 2008): Deals with flexible mica flake tape for insulation of electrical machines.

IS:9299 (Part 3/Sec. 4) (Reaffirmed 2008): Deals with rigid mica materials for heating equipment.

IS:13357: Methods of grading and visual classification of muscovite mica splittings.

TRADE POLICY

As per the Foreign Trade Policy for 2015-20 and the effective Export-Import Policy, exports and imports of varieties of mica blocks, splittings, powder, waste and scrap under heading 2525 are allowed without restrictions.

WORLD SCENARIO

Resources of scrap and flake mica are available in clay deposits, granite, pegmetite and schist and are considered more than adequate to meet anticipated world demand in the foreseeable future. World resources of sheet mica have not been formally evaluated because of the sporadic occurrences of this material. Large deposits of mica bearing rock are known to exist in countries such as Brazil, India and Madagascar. Limited resources of sheet mica are available in the United States.

FUTURE OUTLOOK

There are sufficient resources of mica in the country to meet the domestic demand and export requirement. As per the Report of the Sub Group for the 12th Plan (2012-17), Planning Commission of India, there appears to be good demand for wet ground mica, specially in the manufacture of pearlescent pigments which are increasingly used in the Automotive Industry. The Sub Group has recommended that establishment of wet ground mica plants based on imported know-how in the country needs to be encouraged. The quality of Indian ground mica powder, though is acceptable to foreign buyers, it would be beneficial if the material produced is free from iron and if there is maintenance of consistency in the mesh size of the powder. The Sub Group has underlined the need for efforts in this direction. It has also opined that process know-how for recovery of substantial concentration of lithium, rubidium and cesium values contained in some of the mica deposits in the country needs to be developed.

For boosting exports, it would be necessary for Indian Mica Industry to manufacture and export fabricated & value-added mica-based products, such as, mica paper, micanite sheets and mica-based paper.