Mica

What is Mica?

The word Mica is thought to derive from the Latin word "micare", meaning to shine, in reference to its glittering effect when exposed to light. The history of mica dates back to pre-historic times, as mica was known to the ancient Egyptian, Greek and Roman civilisations, and even in the Aztec civilization of the New World.

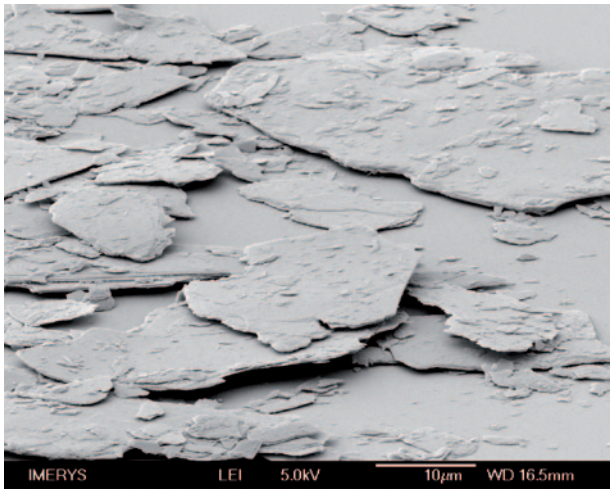
Mica is a phyllosilicate mineral that exhibits an almost perfect basal cleavage. Mica is a group comprising almost 30 members that differentiate from each other, primarily, by atom substitutions or vacancies in the crystal lattice. From an industrial standpoint, very few are mined: Muscovite, white mica, is by far the most common, Phlogopite - a dark brown mica - comes in second. To a lesser extent, lithium mica such as Lepidolite find some interesting applications in our industries.

Amongst platy minerals, micas are unique due to the broad range of particle sizes naturally available from microns up to several centimetres. Mica elementary crystals are three-layer platy minerals: they consist of two tetrahedral sheets and one octahedral sheet, so called Te-Oc-Te to describe the fact that 2 layers consisting of 3/4 [SiO4]- and 1/4 [AlO4]-tetrahedrons enclose the [M(O4,(OH)2)]-octahedron layer (M = Al for muscovite and Mg for phlogopite with the exception of a few substitutions, primarily Fe). This elementary sheet structure is approximately 10 angströms thick.

The Te-Oc-Te structure has a slight negative charge that is compensated by inter-layered cations (in natural form, predominantly K+ ions) located in the intersheet region. The bonding strength between inter-layered cations and tetrahedral sheets, together with the steric effect, make the extraction of those cations almost impossible under standards conditions and gives all micas very high chemical and weathering stability. Under selected process routes, thorough delamination is achievable to the benefit of final applications where high levels of film reinforcement and/or barrier properties are expected.

Depending on the nature of their origin, micas contain a variety of accessory minerals in addition to muscovite/phlogopite. These minerals may include quartz, feldspar, kaolin and pyroxene. The presence of these minerals in conjunction with the mica contained in the ore will impact upon both the industrial value of the deposit and the process complexity, reducing or increasing its value depending on the application.

Mica deposits are either mined for mica only, when matrix yield is high enough, or in association with other minerals such as kaolin/feldspar. When Mica is present in soft rock, it is beneficiated through wet processing, typically blunging, gravity separation and flotation. Mica is subsequently dried to attain a moisture content below 1%. In hard rocks, the preferred process is crushing, directly after drying, followed by sieving and magnetic separation. According to the final application, mica needs to be milled to the required particle size distribution and simultaneously delaminated to enhance its aspect ratio (particle diameter / thickness). This is obtained either through merely sieving (flakes form), or dry milling (into powder and micronised powder form) or wet milling for the most engineered grades with high smooth sheet surface and particle edges. Processor knowledge is critical in the balance of size reduction / delamination ratio. For special applications, mica can be further calcined or surface treated (grafted with organic functions or coated with iron oxide) in order to enhance specific attributes such as compatibility with polar polymer matrix.



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Varied properties – multiple uses

- **Automotive:** Micas in coarse and highly delaminated flakes are widely used in bitumen foils production that are attached onto the inner vehicle frame structures to dampen vibrations. They can be also applied in a spray form in less accessible areas.
- **Brake pads & Clutches:** Thanks to its high thermal resistance and platy structure, mica is added to frictional systems to impart better heat transfer in conjunction with noise reduction.
- **Decoratives:** Several niche markets highly appreciate mica for its glittering and aesthetic effects. Mica can be found in various products such as decorative paints, ceramics, decorative concrete, post cards, wall papers…
- **Drilling:** Another conventional use of mica is as a mud constituent for oil well drilling. Its main role is to seal the borehole walls to prevent leakage and pressure loss when the drill bit encounters fractured areas.
- **Fibre Cement:** Mica is used in high engineered fibre cement to impart dimensional stability either in moisturising conditions or in passive fire protection.
- **Fire extinguisher:** In this application, mica provides anti-caking & flowability. This is vital, ensuring the dry powder will be properly and quickly blown out of the extinguisher tank.
- **Foundry:** Mica is used for coatings in iron casting and to a limited extent in aluminium production casting. It provides several properties both in the coating preparation – e.g. rheology & stability - and once applied on the inner mould surface: mica provides a constant thickness layer on vertical walls, anti-veining effect, and provides a barrier between the sand mould and the molten iron.
- **Paints & Coatings:** An application where mica is widely used for its reinforcement properties, preventing cracks in particularly thick films as the drying process induces shrinkage. Thanks to its barrier properties, mica brings high value in external renderings and anti-corrosive paints.
- **Paper coatings:** High aspect ratio mica, with it's clean surface and smooth edges, imparts the highest barrier properties. This property is much appreciated in packaging products as it provides protection from the water or grease associated with the food. As a natural product, it offers an environmentally friendly solution versus the traditional organic binders.
- **Plastics:** Mica acts as a reinforcing additive and is mainly used in compounds further transformed in the packaging industry -mica reduces warpage in thin plastic frames - and in the automotive industry. Thanks to its low coefficient of thermal expansion, mica imparts dimensional stability in complex and long shape pieces.
- **Plasterboard & Joint compound:** Mica is used primarily as an anti-cracking and reinforcing additive. It provides good rheological properties and allows the smooth application of the joint paste.
- **Pearlescent pigments:** Mica is the only natural substrate that provides a pearlescent effect once it has been coated with TiO2 or Fe2O3.
- **Rubber:** Due to its platy structure, mica is used either as a demoulding agent during the vulcanisation process, or as an anti-sticking powder when several rubber pieces are stacked together.
- **Welding rods:** Mica brings added value both during the rod manufacturing step (ease the extrusion) and the welding itself. During welding, the platy structure acts like a shield protecting the molten steel from ambient air oxidation and moisture.

For more information, please contact:

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