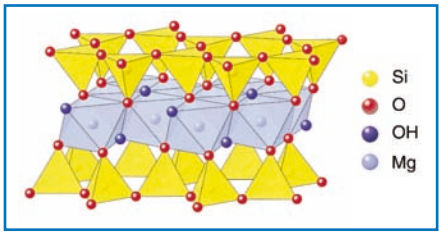
Talc

What is talc?

Talc is the world's softest mineral. Although all talc ores are soft, platy, water repellent and chemically inert, no two talcs are quite the same. Talc is a vital part of everyday life. The magazines we read, the polymers in our cars and houses, the paints we use and the tiles we walk on are just some of the products that talc enhances.

Talc is a hydrated magnesium sheet silicate with the chemical formula $Mg_3\ Si_4\ O_{10}\ (OH)_2$. The elementary sheet is composed of a layer of magnesium-oxygen/hydroxyl octahedra, sandwiched between two layers of silicon-oxygen tetrahedra. The main or basal surfaces of this elementary sheet do not contain hydroxyl groups or active ions, which explains talc's hydrophobicity and inertness.

Talc is practically insoluble in water and in weak acids and alkalis. It is neither explosive nor flammable. Although it has very little chemical reactivity, talc does have a marked affinity for certain organic chemicals, i.e. it is organophilic. Above 900°C, talc progressively loses its hydroxyl groups and above 1050°C, it re-crystallises into different forms of enstatite (anhydrous magnesium silicate). Talc's melting point is 1500°C.



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Morphology

The size of an individual talc platelet (= a few thousand elementary sheets) can vary from approximately 1 micron to over 100 microns depending on the deposit. It is this individual platelet size that determines a talc's platyness or lamellarity. A highly lamellar talc has large individual platelets whereas a microcrystalline talc's platelets are much smaller.

The elementary sheets are stacked on top of each other, like flaky pastry, and, because the binding forces (known as Van der Waal's forces) linking one elementary sheet to its neighbours are very weak, the platelets slide apart at the slightest touch, giving talc its characteristic softness.

Related minerals

Talc ores also differ according to their mineralogical composition (i.e. the type and proportion of associated minerals present). They can be divided into two main types of deposits: talc-chlorite and talc-carbonate. Talc-chlorite ore bodies consist mainly of talc (sometimes 100%) and chlorite, which is hydrated magnesium and aluminium silicate. Chlorite is lamellar, soft and organophilic like talc. It is however more hydrophilic. Talc-carbonate ore bodies are mainly composed of talc carbonate and traces of chlorite. Carbonate is typically magnesite (magnesium carbonate) or dolomite (magnesium and calcium carbonate). Talc-carbonate ores are processed to removed associated minerals and to produce pure talc concentrate.

Multiple properties – manifold uses

Talc's properties (platyness, softness, hydro-phobicity, organophilicity, inertness and mineralogical composition) provide specific functions in many industries.

- **Agriculture and Food:** Talc is an effective anti-caking agent, dispersing agent and die lubricant and therefore contributes to more efficient functioning of animal feed and fertilizer plants. In premixes and agricultural chemicals, it makes an ideal inert carrier.

  Talc is also used as an anti-stick coating agent in a number of popular food products and processes including chewing gum, boiled sweets, cured meats, and for rice polishing. In olive oil production, it increases yield and improves the clarity of the oil.

- **Ceramics:** Talc is a phyllosilicate which imparts a wide range of functions to floor and wall tiles and sanitary-ware, tableware, refractories and technical ceramics. In traditional building ceramics (tiles and sanitary-ware), it is used essentially as a flux, enabling firing temperatures and cycles to be reduced.

In refractory applications, chlorite-rich talcs are transformed into cordierite to improve thermal shock resistance. For steatite ceramics, microcrystalline talcs are the most appropriate. During firing, the talc is transformed into enstatite, which possesses electro-insulating properties, while very low-iron-content talcs are particularly suitable for use in frit, engobe and glaze compositions.

- **Coatings:** Talcs confer a whole range of benefits to coatings. In interior and exterior decorative paints, they act as extenders to improve covering power and titanium dioxide efficiency. Talc's lamellar platelets make paint easier to apply and improve cracking resistance and sagging. They also enhance matting. In anti-corrosion primers, talcs are used to improve corrosion resistance and paint adhesion. They also bring benefits to inks, jointing compounds, putties and adhesives.
- **Paper:** Talcs are used in both uncoated and coated rotogravure papers where they improve printability and reduce surface friction, giving substantial improvements in productivity at the paper mill and print house. They also improve mattness and reduce ink scuff in offset papers. Used as pitch control agents, talcs "clean" the papermaking process by adsorbing any sticky resinous particles in the pulp onto their platy surfaces, thereby preventing the agglomeration and deposit of these on the felts and calenders. As opposed to chemical pitch-control products that pollute the process water, talc is removed together with the pulp, enabling the papermaker to operate more easily in closed-circuit. In speciality papers, such as coloured papers or labels, talcs help to improve quality and productivity.
- **Personal Care:** As it is soft to the touch and inert, talc has been valued for centuries as a body powder. Today it also plays an important role in many cosmetic products, providing the silkiness in blushes, powder compacts and eye shadows, the transparency of foundations and the sheen of beauty creams. In pharmaceuticals, talc is an ideal excipient, used as a glidant, lubricant and diluent. Soap manufacturers also use talc to enhance skin care performance.

- **Plastics:** Talcs impart a variety of benefits to polypropylene, for instance higher stiffness and improved dimensional stability. In automotive parts (under-the-hood/bonnet, dashboard, bumper interiors and exterior trim), household appliances and white goods. Advanced milling technology is required to obtain the finest talcs without diminishing the reinforcing power of their lamellar structure.

  Talcs are also used for linear low density polyethylene (LLDPE) antiblocking and as a nucleating agent in semi-crystalline polymers. In polypropylene food packaging applications, talc is a highly effective reinforcing filler.
- **Rubber:** Talcs reduce the viscosity of rubber compounds, thereby facilitating the processing of moulded parts. They also improve extrudate qualities, increasing production rates and enhancing UV radiation resistance of exterior parts such as automotive profiles. In sealants and gaskets, they provide good compression resistance, whilst in pharmaceutical stoppers, they create a barrier against liquids. In cables, talcs function as insulators and in tyre manufacture they make excellent processing aids.
- **Wastewater treatment:** Speciality talc can improve the performance of biological wastewater treatment plants. The talc particles ballast the flocs of bacteria and accelerate their sedimentation. The addition of talc results in top quality discharge and zero bacterial loss. It can help to upgrade plants without resorting to costly plant expansions. As opposed to most chemicals used to clean wastewater, such as chlorine or aluminium salts, talc is a natural, environmentally-friendly mineral additive. And because it is inert, it preserves the fertilising value of sewage sludge.

For more information, please contact:

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