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Marine *Newslink*

NOVEMBER 2021

FEATURE ARTICLE
Ilmenite

PHOTO(S) OF THE MONTH
Ship loadings

BACK-TO-BASICS
QOTM & Winners

Ilmenite is a titanium-iron oxide mineral with formula: $FeTiO_3$. It is a noteworthy wellspring of titanium. Intergrowths with hematite or magnetite are common and ilmenite can be mistaken for these minerals because of its opaqueness. Ilmenite is nonmagnetic or very weakly magnetic; and it can be distinguished from hematite by its black streak. It may weather to a dull brown colour. It is widely distributed as an accessory mineral in igneous rocks, such as diorite and gabbro. It is a frequent accessory in kimberlite rocks, associated with diamond. It is also found in veins, pegmatite rocks and black beach sands associated with magnetite, rutile, zircon, and other heavy minerals.

Ilmenite forms as a primary mineral in mafic igneous rocks and is concentrated into layers by a process called “magmatic segregation". It crystallizes out of a magma relatively early before most of the other minerals. As a result, the heavier crystals of ilmenite fall to the bottom of the magma chamber and collect in layers. It is these layers that constitute a rich ore body for titanium miners. Ilmenite also occurs in pegmatites and some metamorphic rocks as well as in the sedimentary rocks that are formed from the weathering and erosion. Since its discovery, the mineral ilmenite has grown greatly in its importance. It is now the most important ore of titanium.

Ilmenite is ultimately converted into pigment grade titanium dioxide via either the sulfate process or the chloride process. Sulfate process plants must utilise low-vanadium ilmenite, as vanadium is a penalty element. Titanium dioxide pigment can also be produced from higher titanium content feedstocks such as upgraded slag, rutile and leucoxene via a chloride acid process. Sulphate and chloride process pigment tends to be used for lower and higher quality applications respectively, while users more and more preferring the chloride process.

Ilmenite is an economically important and interesting mineral. It is named for its place of discovery, such places are called type localities, at Ilmen Lake in the Ilmen Mountains, Miask in the southern portion of the Ural Mountains of Russia.

Application

Most ilmenite is mined for titanium dioxide production. Finely ground titanium dioxide is a bright white powder widely used as a base pigment in paint, paper and plastics.

It is the essential mineral of titanium metal.

Limited quantities of titanium joined with specific metals will create sturdy, high-quality, lightweight combinations. These compounds are utilized to produce a wide assortment superior parts and instruments.

Prime usage of derivatives of Ilmenite includes aerospace machine parts, counterfeit joints for humans and donning hardware, for example, bike outlines.

The vast majority of the rest of the ilmenite is utilized to make titanium dioxide, a dormant, white, exceptionally intelligent material. The most significant utilization of titanium dioxide is as a whiting. Whiting are white, exceedingly intelligent materials that are ground to a powder and utilized as shades. These shades produce a white shading and splendour in paint, paper, glues, plastics, toothpaste, and even sustenance. Some ilmenite is additionally used to create engineered rutile, a type of titanium dioxide used to deliver white, very intelligent shades.

Most ilmenite ore production from Canada, South Africa and Norway is intended for titaniferous slag application. Carbon (anthracite) and energy are added in large electric arc smelting furnaces to convert the ilmenite into molten iron bath and slag rich in titanium dioxide. The iron can be further processed as Pig Iron, as continuous cast steel billets, or as iron or steel powders.

Ilmenite ore is used as a flux by steelmakers to line blast furnace hearth refractory.

Ilmenite sand is also used as a sandblasting agent in the cleaning of diecasting dies.

North America and Europe together consume about 50% of the world's titanium dioxide production. Demand by India and China is growing rapidly and may eventually surpass Western consumption.

Shipment

Mostly shipped in bulk. This cargo is to be kept as dry as practicable possible.

Properly trimmed Ilmenite sand, which has a clinging tendency and a large angle of repose, is not likely to shift. But with part shipments in large compartments, the ilmenite when in bulk should be over stowed, or if this is not possible, adequate steps taken to avoid any shifting. The cargo, on account of its weight, should be well spread over the ship in order to avoid undue strains. It is dustless.

Also shipped in bagged form between 50 kg

to 1-ton bags, usually bags are containerised but can be shipped in break-bulk also on ship.

A more cost-effective methods of shipping ilmenite in containers is by using liner bags which allows cargo to be loaded in bulk form & even spread across container. However, the cargo must be trimmed properly to ensure that any pyramid forms will not shift inside the container causing uneven weight distribution.

Risk factors
Liquefaction/Moisture damage

What is cargo liquefaction?

The phenomenon is triggered increase in water pressure that makes solid bulk cargoes (granular materials that are loaded directly into a ship's hold) turn from a solid state into a liquid state, causing a ship to tilt and potentially capsize.

Mined bulk cargoes are typically ‘two-phase’ materials as they contain water between the solid particles. When the particles can touch, the friction between them makes the material act like a solid (even though there is liquid present). But when the water pressure rises, these inter-particle forces reduce, and the strength of the material decreases. When the friction is reduced to zero, the material

acts like a liquid (even though the solid particles are still present).

Solid bulk cargo that is apparently stable on the jetty can liquefy because pressure in the water between the particles builds up as it is loaded onto the ship. The vibration and motion of the ship from the engine and the sea, during the voyage, increases the water pressure and leads to liquefaction of the cargo.

When bulk cargo liquefies, it can shift or slosh inside a ship's hold, making the ship less stable. A liquefied cargo can shift completely to one side of the hold. The cargo will remain in the shifted position, causing the ship to permanently tilt or 'list' on one side. The cargo can still shift further, increasing the angle of list.

At some point, the angle of list becomes so great that seawater enters the hull through the hatch covers and the ship is no longer stable enough to recover from the rolling motion caused by the waves. As a result of liquefaction and subsequent sloshing of free water it can further impact the vessel's stability putting the ship at danger of sinking.

if bulk cargo is shipped at a moisture content in excess of its TML (Transportable Moisture Limit), it may liquefy. Hence, IMSBC (International Maritime Solid Bulk Cargoes) Code requires prescribed TML for shipping such cargoes on ships.

Transportable Moisture Limit (TML) for bulk cargoes is done by taking representative samples of cargo and determining the Flow Moisture Point (FMP). The FMP is the point at which a granular bulk material becomes fluid. A Flow Table Test (FTT) is conducted to find the FMP, with the TML calculated to be 90% of this figure. This is the maximum moisture level at which it is safe to ship the material; if the cargo is found to have a higher moisture content than the TML, it is strongly recommended that the cargo not be transported (unless the vessel is specially built for this).

Contamination

During storage or transportation, the ilmenite may come in contact with residues of earlier cargoes or cargoes stored in nearby stockpiles. The heavy wind & weather may cause the cargoes to mix or get inundated which may result in contamination as well as shortages.

Shortages & contamination can also be attributed to barge movements.

Varieties of ilmenite

Cr-rich Picroilmenite	A cromium- and magnesium-rich variety of ilmenite, containing up to 8.6% Cr_2O_3 and up to 17.0% MgO.
Ferrian Ilmenite	containing up to 33% Fe_2O_3 in solid-solution in the rhombohedral series Fe_2O_3-$FeTiO_3$.
Guadarramite	A supposed radioactive variety of ilmenite
Hystatite	A ferrian variety of ilmenite. On material from Arendal.
Iserine	A supposed cubic form of ilmenite.
Kibdelophane	A high Ti
Magnesian Chromian Ilmenite	A Mg-Cr-bearing variety from DeBeers mine (kimberlites), associated, i.a., with hawthorneite.
Magnesian Menaccanite	A magnesian variety of ilmenite.
Magnesian ilmenite	A variety of ilmenite with some Mg replacing Fe^{2+}.
Magnetoilmenite	A ferrian variety of ilmenite.
Manaccanite	A ferrian variety. [Clark, 1993 – “Hey’s Mineral Index”]
Manganilmenite	A manganian variety of ilmenite.
Manganoan Ilmenite	manganese-bearing variety of ilmenite. The pure Mn endmember is pyrophanite.
Picrocrichtonite	A magnesian variety of ilmenite.
Picroilmenite	A Mg-rich variety of ilmenite.
Picrotitanite	A magnesian variety of ilmenite.

PHOTOS OF THE MONTH

SHIP LOADING ON QUAYSIDE

ANCHORAGE LOADING BY BARGES

BACK-TO-BASICS

QUESTION OF THE MONTH

Insured was doing stock transfer between plant & their main warehouse. The truck was loaded with liquid raw material & finished goods. Next day, the transporter reported that there was attempted hijack by some miscreants and during the tussle with driver, miscreants lost control of the truck & it has met with an accident. One 20L container of liquid material leaked and damaged the primary packaging of some nearby finished goods cargo. However, the FG cargo itself was not damaged at all but only has oil stains on packaging. Rest of the cargo was undamaged. Client intimated claim asked for full value of stained cargo. What should be the stand of Insurer?

LAST MONTH'S QUESTION

"An Indian client was importing high value machinery from Europe on CFR basis by Sea. He took an All-Risks policy from Indian Insurance company, from European loadport to Indian discharge port and from there till final destination warehouse in India. After the cargo reached discharge port, it was stored at customs-bonded warehouse. As per the duration clause in the policy, the client had 60 days to clear the cargo and reach final destination. On 60th day, the client arranged for clearing and delivery of cargo. The machine was loaded on the truck, but the truck developed some technical issue. After much consultation with a truck repairing company, it was understood that the problem could not be fixed at the location and hence the machine had to be unloaded. By this time 60 days period was over. Next truck could only be arranged by next day, and while loading, the machine fell down and got damaged. The Insured lodged a claim."

Is the claim tenable?

ANSWER

Since, the machine was stored in bonded warehouse ordinary course of transit was interrupted and the cover ceased on storage in bonded warehouse and therefore the claim is not tenable

Please send your replies/answers ONLY to: marine.newslink@tataaig.com

CORRECT ANSWERS SENT BY: (In order of replies received)

- V Ganesan — Marsh India Insurance Brokers Pvt. Ltd., Chennai
- Satish Marathe — Nasco Middle East, Dubai
- Arun Kumar — SBI General Insurance Company Ltd.
- Punit Pandya — The New India Assurance Co. Ltd., Surat
- Sohag Parikh — Cadila Healthcare Ltd., Ahmedabad
- Paresh Shah — Madhuvan Insurance Broking Services Pvt Ltd., Ahmedabad
- Ashish Sharma — Shree Cement Ltd., Ajmer
- Azad Kumar — UIB Insurance Brokers (India) Pvt. Ltd., Mumbai
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