PETALITE CHARACTERISTICS & MARKET

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TERRA STUDIO

CHARACTERISTICS

Petalite is a lithium aluminium phyllosilicate mineral with chemical formula $LiAlSi_4O_{10}$. Petalite occurs in lithium-bearing pegmatites with spodumene, lepidolite, and tourmaline.

Petalite contains comparatively less lithium than spodumene but more than lepidolite, with a theoretical maximum of 4.9% Li_2O. Petalite is processed into a concentrate where it is used in either the EV & battery storage industry or glass & ceramics industry. Upon heating and applying pressure, petalite converts to beta spodumene-quartz in the solid solution phase.

PRODUCTION

In terms of producers, there are one mine in operation and one project at an advanced stage of development both in Zimbabwe.

Zimbabwe

At Bikita Minerals, the main lithium mineral extracted and concentrated is petalite, which is predominantly exported to South Africa where it is consumed domestically or shipped onwards to consumers in China and Europe. In 2017, Bikita Minerals production totalled 5,300 tonnes Lithium Carbonate Equivalent (LCE) in petalite mineral concentrates. Bikita Minerals markets petalite containing 4.1% Li_2O.

Source: Bikita Minerals, Flare Aerial Productions, YouTube video

Bikita is producing and exporting 50-55,000 tpa of petalite. Note 52,500 tonnes @ 4.1% Li_2O = approx. 5,323 t LCE.

In 2018, Bikita's production is forecast to total 7,500 tonnes LCE (roughly 71,500 tonnes petalite concentrate).

The Arcadia lithium project in Zimbabwe is the only lithium hard rock project that can produce both spodumene and petalite products. Prospect's average annual concentrate production is expected to be approximately 212,000 tonnes of 6% spodumene, 216,000 tonnes of 4% petalite, and 188,000 pounds of tantalum pentoxide. This places Prospect Resources as the largest petalite producer in the world and a significant producer of spodumene.

Source: Prospect Resources, Arcadia Lithium Project site and Petalite samples

GLASS AND CERAMICS INDUSTRY

Although petalite is able to supply the EV and energy storage industries, it is unique for its thermal properties; as it has a very low rate of thermal expansion, making it a valuable addition across the glass & ceramics industry. The glass and ceramics industry is the largest market after the rechargeable batteries industry for the lithium market, equating to over 25% of total lithium market demand. The glass and ceramics market is mature, with producers such as Schott AG using petalite in their products.

Petalite has close to 0% thermal expansion, making it one of the best additives for this purpose. Petalite is unique as it is suitable for white and transparents products due to its low iron content. It does not present the frothing problems generally associated with spodumene. A low iron lithium concentrate is able to be achieve through petalite as its crystalline structure is more easily able to separate mica in the production process and therefore lowering the alkali and iron from the product. This fit for purpose specification for the glass & ceramics industry positions low iron petalite producers to potentially receive premium pricing vs higher iron products such as spodumene.

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PETALITE APPLICATIONS

Petalite mineral acts as the main raw materials for extracting lithium metal and producing lithium compounds. Brightly coloured one can be the raw material and adornment material of gem and artistic handicraft. It is mainly used in ceramics, glass, enamel, paint, and metallurgical industry.

Ceramics


Tiles

Adding low iron petalite in ceramic bodies improves the strength, density, acid resistance and heat resistance of ceramic products, and also reduces the water absorption rate and linear shrinkage. It reduces the thermal expansion coefficient of the products, improves high temperature glaze liquidity, lowers melt viscosity and improve glaze whiteness, glossiness, hardness, and corrosion resistance, improves the grade of products, by adding the right amount of ceramic grade low iron petalite in glazes and frits, at the same time, make the final product beautiful and durable.

Glass

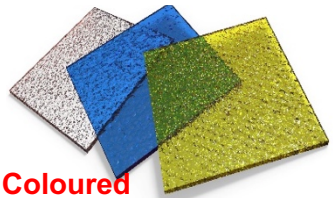

Projector Lenses

The addition of low iron petalite to glass formulations simplifies the production process by reducing melting temperature and viscosity of the melt, promoting melt homogenization, and is conducive to product moulding and increased production volumes. It also promotes reduced energy consumption, prolonged furnace life and reduced pollution. It is an effective way of reducing the cost and improving the physical and chemical properties of the glass and the appeal of finished products.

The production of low-temperature glass can reduce the use of alkali in melt formulations. Its high lithium oxide content makes low iron petalite useful in the production of ultraviolet glass, expanded glass and electromagnetic furnace glass panels.

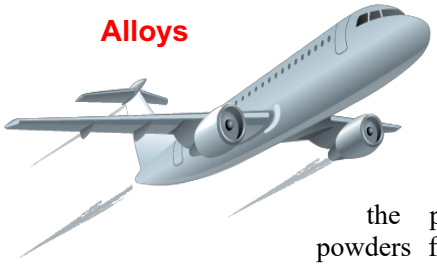
In glazes, low iron petalite tends to create silky white surfaces at high and low temperatures and in both oxidation and reduction atmospheres. Its low iron content make it a popular glaze additive for white and clear glazes, as it melts without delivering a noticeable tint.

Glass-ceramics


Coloured Glass Panels

Glass-ceramic producers commonly use low iron petalite, low iron spodumene and lithium carbonate. In general, petalite and spodumene are used for opaque and coloured glass-ceramic panels while lithium carbonate is used for translucent panels, particularly stove and furnace windows and architectural and special glass-ceramic objects such as fire doors and mirror substrates. For example, Schott uses lithium carbonate in the production of translucent ROBAX glass-ceramic and spodumene and petalite in opaque glass-ceramic CERAN products.

Metallurgical powders


Alloys

In addition to the high-volume glass and ceramics categories described above, low iron petalite is also used for the production of lithium powders for the development of industrial alloys such as Aluminium-Lithium, which are primarily used in the aerospace industry due to the weight advantage they provide.

These alloys traditionally use up to 2.45% lithium in their composition. This reduced weight leads to significant fuel savings compared to composites and at a lower cost than the use of titanium. This is used across commercial airlines, helicopters, Formula One cars and in space shuttles.

Other

Beyond the petalite producer and project only one spodumene producer, Greenbushes, is able to produce a concentrate product that meets the Glass and Ceramics “low iron” specifications. Lithium Carbonate is also able to supply the Glass and Ceramics industry, as it has been further processed and removed the iron and other impurities.

OUTLOOK FOR CONSUMPTION OF LITHIUM IN GLASS-CERAMICS

The largest market for glass-ceramics is cooktops and stove windows. This market is driven by consumer trends and levels of construction, particularly residential construction. Growth in demand for these products is likely to be similar to demand for household appliances, which is forecast by Roskill to increase by 2-3% per annum.

Demand for lithium in glass-ceramics is forecast to increase by a lower growth rate given increases in recycled material availability rising to around 30,190 tonnes LCE in 2027 (vs 23,600 tonnes LCE in 2017). Two areas which could potentially realise high growth rates for lithium in glass-ceramics are LED substrates and 3C touchscreens, although these will be from a low base in volume terms given their recent entry into these respective markets.

REFERENCES

2018 – Roskill – *Lithium: Global Industry, Markets and Outlook to 2027*, Fifteen Edition

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