

27 January 2016

## **WORLD CLASS TEST RESULTS SUPPORT EXPANDABLE GRAPHITE MARKET PUSH**

***Expandability results underpin strong interest from graphite end users for Chilalo product***

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### **Highlights**

- Testwork conducted by major Chinese end user confirms expansion rates exceeding 1,000 times - (ie. 1 gram of Chilalo graphite produces over 1 litre in volume of expandable graphite)
- Chilalo graphite has highest expandability of all graphite they have tested, both domestic and international
- Confirms suitability for the high-margin, fast-growing expandable graphite market
- Confirms Chilalo's coarse flake graphite is suitable for production of high-value products such as graphite foil and graphite paper whilst Chilalo's fine and medium flake graphite confirmed as ideally suited to the high volume flame retardant building materials market
- Demand for expandable graphite set to rapidly accelerate following introduction of Chinese legislation mandating the use of flame-retardant building materials in construction of new buildings and renovations to existing buildings
- Discussions with major Chinese consumer of expandable graphite at an advanced stage

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IMX Resources Limited's (**ASX: IXR**) ('**IMX**' or the '**Company**') strategy to pursue the lucrative expandable graphite market has been validated after end user testing confirmed the outstanding suitability of the flagship Chilalo Graphite Project in Tanzania to supply this high growth sector.

Feedback from IMX's targeted end user, with whom the Company is in advanced discussions, confirmed exceptional expansion rates exceeding 1,000 times, indicating that Chilalo graphite is ideally suited to a range of high-value and in-demand products.

In particular, Chilalo coarse flake graphite in excess of 180 microns has been identified as suitable for the production of high value expandable graphite products such as graphite foil, graphite paper, knitted tape (high temperature and fire resistance), narrow flexible graphite strip, and other graphite based products requiring high rates of expansion. Chilalo fine and medium flake graphite (<180 microns) has been confirmed as suitable for application in flame retardant building products, where lower rates of expansion are required. The high expansion rates mean that for the same quantity of graphite, Chilalo produces a higher volume of expandable graphite meaning the product can attract a premium due to a higher "value in use".

IMX Managing Director Phil Hoskins said the results opened up enormous new market opportunities for Chilalo graphite and reduced IMX's reliance on the market to supply graphite into lithium-ion batteries.

*“Coarse flake graphite is theoretically suitable to many different end uses including refractories and spherical graphite, but in the absence of costly chemical or thermal purification, maximum revenue is achieved selling it into the expandable graphite market. However, not all graphite expands and some graphite expands at a higher rate and it is therefore pleasing that our targeted end user has confirmed Chilalo’s world-class expansion rates and validated the Company’s strategy of targeting this high growth market.*

*“Chilalo’s finer flake product is still expected to be suitable for the manufacture of spherical graphite for lithium-ion batteries, ensuring the project maintains exposure to this rapidly growing market segment. However, spherical graphite is exclusively produced using fine and medium flake graphite (<180 microns) which is likely to be an oversupplied market given we understand China has approximately 800ktpa idle capacity for finer flake graphite and Syrah Resources plan to produce over 300ktpa, the majority of which is finer flake targeting the battery market. Having received confirmation that the rate of expandability of Chilalo graphite at finer flake sizes is suitable for the production of expandable graphite, the Company has product optionality in that we can choose to supply either the battery market or the rapidly growing expandable graphite market where its use in flame retardant building materials is expected to offer outstanding opportunities for IMX.”*

Videos demonstrating the expandability of Chilalo graphite will today be placed on the IMX website ([www.imxresources.com.au](http://www.imxresources.com.au)).

Feedback from end users is that expansion ratios from Tanzanian graphite are generally known to exceed those from Chinese domestic graphite. These latest test results by the Company’s targeted end user, a major Chinese consumer, have placed Chilalo product number one for expandability compared to both Chinese domestic and international graphite they have tested. In recent years, demand in China for larger flake graphite has increased and the domestic supply of the required quantity and quality of such graphite is insufficient to meet this demand. IMX is ideally placed to take advantage of this opportunity to supply quality coarse flake graphite into China.

Over the past 12 months, IMX has undertaken a program of product marketing activities in China which has included close engagement with various end users, manufacturers, industry bodies and potential offtake partners. These test results underpin the interest from end users with whom the Company is in advanced discussions.

### **Expandable Graphite**

Expandable graphite is a compound of graphite that expands or exfoliates when heated. This material is manufactured by treating flake graphite with various reagents (such as acid) that migrate between the layers in the graphite. When the graphite is heated it rapidly expands to several hundred times its original size (the expansion ratio). The expansion ratio is the volume of expandable graphite produced per gram of graphite product at a specified temperature. In general, coarser flake graphite typically has higher expansion ratios than smaller flakes.

Producing expandable graphite is a relatively inexpensive process and there are no issues with product recoverability with 1 tonne of flake graphite producing between 1.1-1.2 tonnes of expandable graphite with the additional mass coming from reagents and water. This is a positive compared to production of spherical graphite where the yield of spherical graphite from flake graphite is approximately 40%.

China dominates the expandable graphite market producing 95% of the world’s expandable graphite, with the balance produced in the US and Germany (*source: Benchmark Mineral Intelligence 2015*). Given China’s diminished reserves of coarse flake graphite, there is a substantial shortage of coarse flake graphite capable

of producing the quantity of expandable graphite required to meet China's demand, representing a substantial opportunity for IMX. The Company's recent visit to a Chinese factory that is currently producing expandable graphite illustrated this shortage of quality graphite – the graphite feedstock was +100 mesh with an expansion rate of ~200 times (far inferior to Chilalo graphite).

**Figure 1: Expandable Graphite**



Natural flake graphite possesses certain properties including heat resistance, corrosion resistance and self-lubrication. Expandable graphite also possesses other properties including softness, compression resilience, adsorption and radiation resistance.

Expandable graphite is not transported great distances as a finished product because its properties change if it is compressed and it is not cost-effective to do so as it is a low weight but high volume product. As a result, IMX will not produce expandable graphite in Tanzania, but will export directly to the end user for manufacturing.

### **Expandable graphite market**

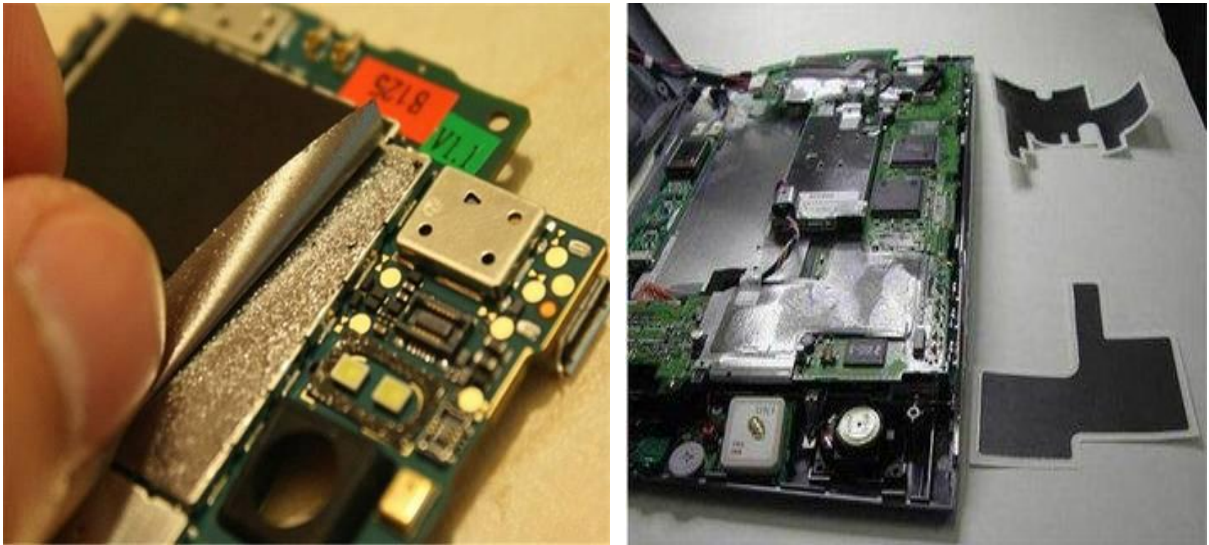
Expandable graphite is one of the fastest growing markets for graphite and has multiple uses, including:

- The production of high-value graphite foils as shown below in Figure 2 (market price of ~US\$ 50,000/t) which are used as heat shields in electronic devices such as mobile phones, laptops and TV screens. Examples of the use of graphite foil in electronic devices is shown in Figure 3.

**Figure 2: Graphite foil produced from expandable graphite**



Figure 3: Electronic devices using graphite foil as a heat shield



- The production of graphite paper used in the manufacture of heat shield gaskets and other products such as fire and thermal seals for machinery and electronic parts.
- With its unique fire and heat resistant characteristics, expandable graphite is being increasingly used in the manufacture of flame retardant and thermally efficient building materials, such as insulation for example, with a rapidly growing market for these products. This is discussed further below.

A video demonstrating the flame retardant characteristics of expandable graphite has been placed on the IMX website ([www.imxresources.com.au](http://www.imxresources.com.au)).

- The radiation resistant properties of expandable graphite also have military applications.

Discussions with Chinese end users over the last six months have revealed that the market size has been entirely restricted by supply and that coarse flake graphite with the expansion characteristics of Chilalo graphite can be readily absorbed by current demand.

End users capable of producing these expandable graphite products are moving to continuous 24 hour plant operations and are still unable to keep up with demand. The current supply / demand imbalance has resulted in long wait times for expandable graphite products with significant up-front payments required to secure orders.

### Flame Retardant Building Materials

The addition of expandable graphite to ordinary insulation foam or cement provides the material with flame retardant properties. It also provides thermal efficiency improving the material's ability to assist in heat retention.

The Company understands that China has recently mandated the use of flame retardant building materials for all future new construction or building renovations. Note that flame retardant building materials are only required in certain aspects of the construction. These regulatory changes are expected to significantly increase the demand for expandable graphite and result in a large volume market.

Whilst IMX hasn't sighted the new Chinese building regulations, they are understood to be made up of four categories of building materials with varying levels of expandable graphite required in each. Category 1

flame retardant building materials being for single storey, lower quality buildings are required to use 5% expandable graphite in their manufacturing. The use of expandable graphite increases up to category 4 flame retardant building materials which are required in buildings consisting of several storeys and are required to use 50% expandable graphite in their manufacturing. IMX is in discussions with end users requiring 10% expandable graphite for their manufacturing of cement and gypsum.

End user feedback still being verified by the Company has estimated the size of the flame retardant building materials market at 5 million tonnes per annum. Assuming that these materials contain anywhere from 5-50% expandable graphite, it is clear to see the potential size of this market which is a game-changer for graphite demand.

The type of expandable graphite suitable for the manufacture of flame retardant building materials can be produced from fine and medium flake graphite (<180 microns), with expansion rates exceeding 100 times. The grade of the graphite can range anywhere from 85-94% total graphitic carbon ('TGC').

### **Expandable Graphite Pricing**

According to existing manufacturers of expandable graphite products, higher end expandable graphite products range in pricing from US\$4,000 to US\$10,000 per tonne depending on the quality and the end use. At the lower end of this range are gaskets, seals and other products used in the manufacturing industry where the expandable graphite has been produced from large flake graphite between 92-94% TGC with high expansion rates.

The upper end of this range is graphite foil and paper produced from high purity (95-96% TGC), coarse flake graphite with high expansion rates. At the extreme, high purity, high expansion graphite capable of producing <3mm graphite foil could fetch up to US\$50,000/t but this requires the application of highly technological processes.

Expandable graphite-based flame retardant insulation foam shown in Figure 4 below currently sells for 350RMB (US\$52.50) per m<sup>3</sup>. This equates to US\$52.50 per 20kg or US\$2,625 per tonne.

**Figure 4: Flame retardant insulation foam**



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#### **About IMX Resources Limited**

IMX Resources is an Australian minerals exploration company that holds a 5,400 km<sup>2</sup> tenement package at the Nachingwea Property in south-east Tanzania. The Nachingwea Property hosts the Chilalo Graphite Project, the Ntaka Hill Nickel Project and the Kishugu and Naujombo Gold Prospects. IMX's primary focus is on developing the high-grade and coarse flake Chilalo Graphite Project. The Pre-Feasibility Study ('PFS') released on 23 November 2015 outlined a low cost, high-margin operation, with attractive project economics and confirmed the potential viability of a small scale open pit mining and conventional flotation processing operation. The PFS is based on a high-grade Indicated and Inferred JORC Mineral Resource of 9.2 Mt grading 10.7% Total Graphitic Carbon ('TGC'), comprised of an Indicated Resource of 5.1 Mt grading 11.9% TGC for 613,800 tonnes of contained graphite and an Inferred Resource of 4.1 Mt grading 9.1% TGC for 370,300 tonnes of contained graphite. Chilalo is located approximately 220 km by road, from the deep water commercial Mtwara Port, the majority of which is a sealed main road. IMX aims to become a respected supplier of high quality graphite.

To find out more, please visit [www.imxresources.com.au](http://www.imxresources.com.au).