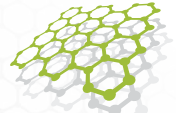


Graphene Goes Large

Case Study - PureGRAPH™ performance in mining equipment



first graphene

The world's leading graphene company

PureGRAPH™ graphene products are used to increase strength and abrasion resistance in wear liner products used in the mining and mineral handling industries. The technology has been developed in close collaboration with a customer, newGen Group who has now launched a series of ArmourGRAPH™ branded high performing wear protection products.

Background:

The global mining industry excavates, transports and processing 50 million tonnes of ore every year, with the iron ore industry alone processes approximately 50 million tonnes of ore per year. Inevitably, the equipment that handles this ore suffers from wear and the industry uses a range of strategies to prevent wear and prolong equipment running times.

Sacrificial polymer liners are routinely used to protect the steel equipment from wear; the key benefit being that the production downtime to replace a polymer liner is relatively short. Wear is equipment dependent but a typical life time for a liner is six months. A typical application is shown in Fig. 1 with a Sandvik reclaimer, in this case each polymer bucket liner weighs about 200kg.

newGen Group are a mining services company that offer a range of turn-key wear protection systems for mining equipment, providing a range of polymer and ceramic linings to leading mining companies which include BHP Iron Ore, Fortescue and Rio Tinto.

The Collaboration:

In June 2018, newGen and First Graphene Ltd began a collaboration to develop rubber liners with improved wear properties through the use of PureGRAPH™ graphene additives. Initial studies were carried out on polyurethane based liners. PureGRAPH™ graphene powders were mixed into polyurethane resin using standard industrial mixing equipment. No pre-treatment of the graphene additive or other formulation changes were required. A typical cast liner for the Sandvik reclaimer is shown in Fig. 2.



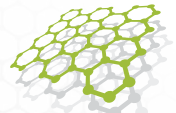
Fig. 1 - Typical Sandvik 12,000 tph bucket-wheel reclaimer.



Fig. 2 - Typical Polyurethane rubber liner weighing ca. 200kg.

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Results:

The initial study focused on tensile strength, elongation and abrasion resistance. Results are presented in Fig. 3. Analysis was carried out by an independent NATA accredited laboratory.

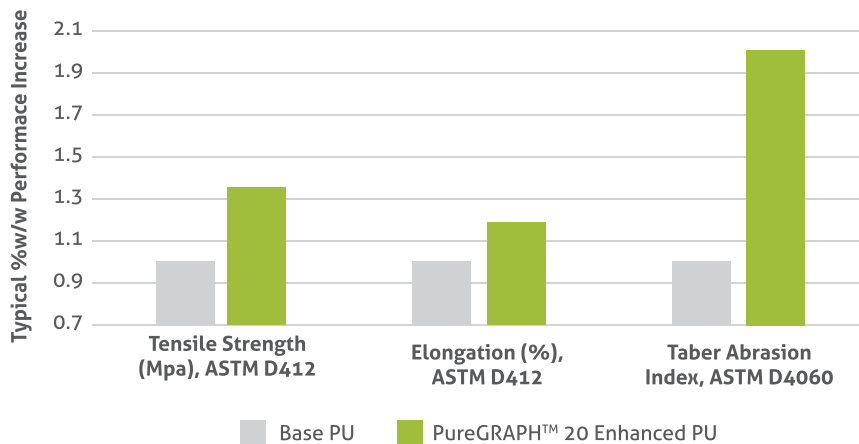


Fig. 3. Performance Results of PureGRAPH™ enhanced Polyurethanes.

Outcomes:

newGen Group have now launched a product range of wear protection liners under their newly created ArmourGRAPH™ brand. Scaled trials are underway with key customers. The products are being introduced across mining and mineral handling operations including reclaimer bucket liners, pipe spooling, dryer chutes and conveyor applications.

This opportunity represents a significant milestone for the emerging graphene industry with tonnage quantities of PureGRAPH™ being required to fulfil the needs of the mining industry.

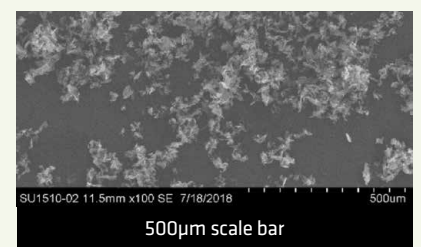
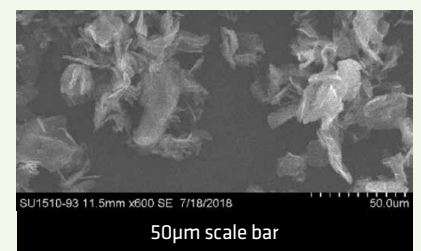
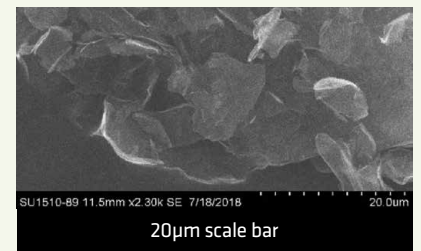
For more information on PureGRAPH™ products please contact us at info@firstgraphene.com.au

LIMITED WARRANTY INFORMATION:

The information contained herein is offered in good faith and is believed to be accurate at the time of printing. This information should not be used as a substitute for your own quality control and/or testing procedures to ensure that our products are safe, effective and fully satisfactory for the intended end use. Suggestions of use shall not be taken as inducements to infringe any patent.

PureGRAPH™ Graphene powders are low defect, high aspect ratio graphene platelets available in three product sizes

- PureGRAPH™ products have well controlled particle sizes at 5µm, 10µm and 20µm for consistent and repeatable performance.
- PureGRAPH™ products disperse readily and easily in solvents, polymer resins, rubber and water-based formulations.
- PureGRAPH™ products are high purity with very low metal and silicon contaminant levels.



Typical SEM analysis of PureGRAPH™ 20