Talga Anode Enables Ultra-Fast Charge Battery

- **New test results show Talga's lithium-ion battery anode product outperforming commercial benchmark and enabling ultra-fast charge rates (>300mAh/g at 20C)**
- **In general terms, enables full charge (0% - 100%) of lithium-ion battery in 3 minutes**
- **Talga moves to trademark its range of lithium-ion anode products as Talnode™**

Australian advanced materials technology company, Talga Resources Ltd ("**Talga**") (**ASX:TLG**), is pleased to announce positive test results of its lithium-ion ("**Li-ion**") battery anode product in enabling ultra-fast charging.

Talga released breakthrough test results of its engineered active Li-ion anode product on 15 May 2018 and since then has accelerated development (Fig 1). In new tests conducted at a leading independent European battery test facility, Li-ion batteries using Talga's anode product were subjected to high charge conditions and benchmarked against a global leading commercial anode product ("CAP").

The test results show Talga's anode product significantly outperformed the CAP across a range of charge rates, and achieved very high charge capacity of >300mAh/g at an ultra-fast charge rate of 20C (see Fig 2 for details and Glossary for technical terms).

In general terms, this anode performance enables a Li-ion battery to be charged from 0% to 100% in 3 minutes without losing its capacity.

Talga Managing Director Mark Thompson: *"Ultra-fast charging is a key goal of Li-ion battery developers and a high value customer deliverable[1]. The target for the next generation of electric vehicles is to charge in the same time it takes to currently fill a tank with fuel. Based on these test results, Talga's new anode material moves battery products closer to this goal."*

1. Reference: "BP invests in ultra-fast charging battery company", 22 May 2018

Figure 1 *Talga's Li-ion anode product ready for aqueous formulation and coating onto current collector.*

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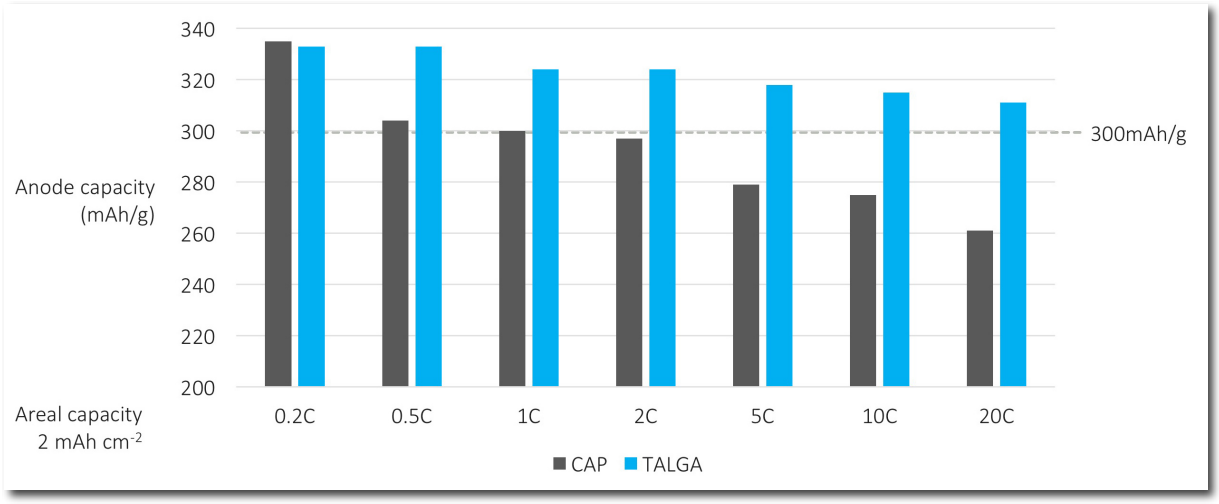
Figure 2 *Fig 2. Test results of battery capacity at increasing charge rates show higher capacity with Talnode™-X (right) benchmarked against commercial anode product (CAP)(left). Note Talnode™-X retains over 300mAh/g at ultra-fast charge rate (up to 20C or 3min). Tests were conducted on a range of coin cells tested to a common protocol with the commercial reference prepared at the same time and under the same conditions.*



Fast-Charge Technical Background

Fast charging of Li-ion batteries is increasingly important as consumers demand reductions in charging time. Faster charging rates, however, have a significant negative impact on the battery life of conventional graphite anode batteries, causing capacity loss.

Fast charging also increases the risk of both internal overheating and the growth of metal dendrites causing a short circuit, leading to potential catastrophic failure (ignition).

The Talga anode product has been engineered to have excess capacity in the anode compared to a conventional cell anode, enabling ultra-fast charge rate of 20C, while top-tier conventional graphite cells lose capacity when charged at only a rate of 5C.

Product and Commercial Activities

In May this year, Talga presented breakthrough test results from our initial Li-ion anode products. Since then, commercial enquiries have accelerated and we have been providing technical information, test results and product samples across the fast growing global battery industry.

Talga has moved to trademark its range of specific Li-ion anode products as "Talnode™". Talnode™ products will have unique designation based on formation and application identified with a suffix, for example the product in this release is Talnode™-X. Talnode™ products are in addition to Talga's other trademarked product lines Talphene® and Talphite®.

Testing of Talnode™-X continues across multiple battery test facilities in Europe and is commencing at a leading independent battery development institute in Asia. Test parameters include customer protocols and specifications, with results benchmarked against current commercial anode materials.

A series of non-disclosure and sample transfer agreements have been executed with a range of European, Japanese and Korean automotive, electrical goods and Li-ion battery manufacturers to support continued technical and commercial discussions. Potential outcomes include technology and product development partnerships, off-take and distribution agreements, and project/ manufacturing partnerships.

About Talga

Talga Resources Ltd is an advanced materials technology company enabling stronger, lighter and more functional products for the multi-billion dollar global coatings, battery, construction and polymer composites markets via graphene and graphite products. The company has significant advantages owing to its 100% owned unique high grade graphite deposits in Sweden and in-house processing and product technology. Joint development programs are underway with a range of international corporations. Company website: www.talgaresources.com

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TECHNICAL GLOSSARY

Anode	The negative electrode in a battery during discharge. In Lithium-ion batteries, it consists of graphite and other carbons coated on copper.
Aqueous anode formulation	A chemical formulation that contains graphite mixed in a water based solution which is suitable to be coated on copper and dried to leave a pure graphite based layer to form the Li-ion battery anode.
Battery capacity	The total battery capacity, usually expressed in ampere-hours or milliampere-hours, available to perform work. The actual capacity of a particular battery is determined by a number of factors, including the material properties, cut-off voltage, discharge rate, temperature, method of charge and the age and life history of the battery.
Battery efficiency	Refer to coulombic efficiency.
Battery module	An assembly of cells in series and parallel encased in a mechanical structure.
Capacity	Capacity represents specific energy in ampere-hours (Ah). Ah is the discharge current a battery can deliver over time.
Capacity fade/ ageing	Permanent loss of capacity with frequent use or the passage of time due to unwanted irreversible chemical reactions in the cell.
Cathode	Electrode that, in effect, oxidises the anode or absorbs the electrons. During discharge, the positive electrode of a voltaic cell is the cathode. When charging, that reverses and the negative electrode of the cell is the cathode.
Charge	The conversion of electric energy, provided in the form of a current, into chemical energy within the cell or battery.
Cell	A closed electrochemical power source. The minimum unit of a battery comprised of 4 key components including cathode, anode, electrolyte and separator. Li-ion battery cells come in three different shapes (design architecture) being prismatic, cylindrical or pouch.
C-rate	C-rate is a measure of the rate at which a battery is charged relative to its maximum capacity. A 1C rate means that the charge current will charge the entire battery in 1 hour (60 minutes), 0.2C means complete charging is made during 5 hours (60minutes/0.2 = 5 hours) and 5C means that complete charging was made in 12 minutes (60 minutes/5 = 12 minutes).
Coin cell	An electrochemical device, composed of positive and negative plates and electrolyte, which is capable of storing electrical energy. It is the basic “building block” of a battery in lab scale tests using circular half or full coin shaped cells.
Coulombic efficiency	The ratio (expressed as a percentage) between the energy removed from a battery during discharge compared with the energy used during charging to restore the original capacity.
Cylindrical cell	Components of a battery assembled inside a cylindrical metal container.
Discharge	The conversion of the chemical energy stored within a cell to electrical energy, and the subsequent withdrawal of this electrical energy into a load.
Few layer graphene (FLG)	Stack of graphene having a total thickness of 5 layers or less.

Graphene	A 1-10 atom thick layer of crystalline carbon, with superlative properties of strength, conductivity and transparency.
Graphene nanoplatelets (GNP)	Stack of Graphene having a total thickness of 10-100 layers and properties of strength, conductivity and barrier properties that far exceed that of Graphite.
Graphite	An allotrope of carbon in which carbon has sp2 hybridisation. Can be found as a natural mineral or can be synthesised using great pressure and temperature. Natural Graphite consists of many stacked layers of Graphene, approximately 3 million layers of Graphene per millimetre of Graphite.
Lithium	A soft, silvery-white metallic element of the alkali group, the lightest of all metals.
Lithium-ion	Elemental Lithium devoid of an electron having an oxidation state of +1.
Lithium-ion battery	Rechargeable battery where lithium-ion shuttles between graphitic anode and cobalt, manganese, nickel and/or other metals in combinations as cathode.
mAh/g	Milli Ampere hours/ per gram – a unit for battery capacity/materials.
Milling	The process of breaking material into small fine parts by grinding following crushing, or machining/cutting material using rotating equipment.
NMC	Lithium Nickel Manganese Cobalt Oxide ($LiNiMnCoO_2$ or NMC). Is one of the most successful Li-ion systems is a cathode combination of nickel-manganese-cobalt (NMC). These systems can be tailored to serve as Energy Cells or Power Cells.
Packaging efficiency	The mechanical structure used to contain and protect a battery's components (cells, electronic circuits, contacts etc.) – the efficiency with which the battery components can be packed in a given volume.
Pouch cell	Battery cell packaged into a flat-shaped flexible, heat-sealable foil pouch.
Prismatic cell	A slim rectangular sealed battery cell in a metal or inflexible case. The positive and negative plates are stacked usually in a rectangular shape rather than rolled in a spiral as done in a cylindrical cell.
Rate Capability	The rate capability specifies the speed a battery is charged or discharged
Reversible Capacity	The reversible capacity is the capacity that is available to the load after the electrode is formed.
Roll to roll fabrication	Continuous fabrication of battery cells using rolled sheets of battery components and coating them with the active materials as they roll onto a spool for subsequent cutting and packaging into cells.
Shaping/ Spheronising	The milling of graphite flakes into sub-15 micron sized spherical shaped particles to reduce size and surface area to suit formulations for Li-ion battery anodes.
Specific Energy	Specific energy, or gravimetric energy density, defines battery capacity in weight (Wh/kg); energy density, or volumetric energy density, reflects volume in litres (Wh/l). Products requiring long runtimes at moderate load are optimised for high specific energy; the ability to deliver high current loads can be ignored.