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ALTECH – COMMENCEMENT OF BATTERY PERFORMANCE TESTS USING HPA COATED GRAPHITE

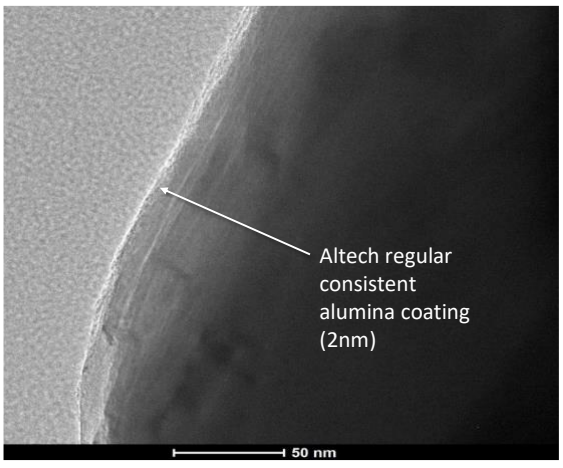
Highlights

- Battery performance testing has commenced
- Specially designed formulation and coating process
- Potential improvements to lithium-ion battery life, capacity and chargeability

Altech Chemicals Limited (Altech/the Company) (ASX: ATC) (FRA: A3Y) is pleased to advise that it has now commenced battery performance testing of graphite particles that have been coated with high purity alumina (HPA), using Altech's coating technology.

On 22 December 2020, Altech announced the successful demonstration of its alumina coating technology to coat graphite particles typical of those used in anode applications within lithium-ion batteries (anode grade graphite), with a nano layer of high purity alumina (HPA). The demonstration showed that Altech's technology was able to deposit a uniform and consistent layer of alumina (approximately 2nm thick) onto anode grade graphite particles. The uniformity and consistency of an alumina layer on anode grade graphite is expected to be important to improve lithium-ion battery performance. Following the completion of the demonstration, Altech proceeded to produce a sufficient quantity of coated graphite to proceed to a first stage of battery test-work, which has now commenced.

Figure 1 – Electron Microscope images of alumina coated graphite particles



For Altech's tests, a batch of electrodes has been produced using non-coated standard anode grade graphite particles (the control), and a separate batch of electrodes was produced using the anode grade graphite that is coated with HPA, using Altech's technology (see Figure 2).

Figure 2 – Preparation of anode component of the half-cell batteries

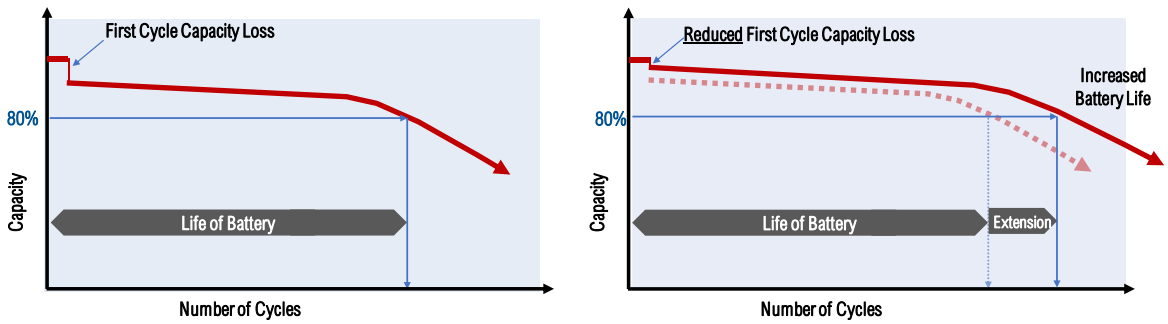
The initial tests, to battery industry standards, are an important first step to demonstrate the gains to be made in lithium-ion battery life using graphite particles that have been coated with HPA via the Altech process. The results of the testing program will be reported as they become available, and further tests are expected to follow.

Background

HPA is commonly applied as a coating on the separator sheets used within a lithium-ion battery, as alumina coated separators improve battery performance, durability and overall safety. However, there is an evolving use for alumina within the anode component of the lithium-ion battery because of the positive impacts that alumina coated graphite particles have on battery life and performance.

Lithium-ion battery anodes are typically composed of graphite. In a lithium-ion battery, lithium ion losses initially present as inactive layers that form during the very first battery charge cycle, the losses then compound with each subsequent battery usage cycle. Typically around 8% of lithium ions are lost during the very first battery charge cycle. This "*first cycle capacity loss*" or "*first-cycle irreversibility*" is a long recognised but as yet poorly resolved limitation that has plagued rechargeable lithium-ion batteries. Figure 4 shows the potential increase in battery life, if the *first cycle capacity loss* can be reduced or eliminated thereby allowing more lithium ions to participate in battery operation during its life-cycle.

Figure 3 – Illustration of potential impact of reduced *"first cycle capacity loss"*



First cycle capacity loss in a lithium-ion battery is because of the consumption of lithium ions within the battery during the initial battery charging cycle. This forms a layer of material on the anode termed a *"solid electrolyte interphase"* (SEI). Currently the graphite particles used in lithium-ion battery anodes are uncoated, however manufacturers are now seeking to coat anode graphite particles with a very thin layer of alumina. Tests have demonstrated that alumina coated graphite particles have the potential to reduce *first cycle capacity loss*. In turn, this innovation can measurably increase battery energy retention, extend battery life and improve overall battery performance.

Altech has launched development of a new product range called *"Anode Grade APC01"* and *"Anode Grade ALC01"*. This product combined with Altech's particle coating technology is expected to improve Coulombic Efficiency (CE) (especially the CE in first cycle), cycling stability, high-rate performance and fast charging capability. Altech intends to focus on tailoring its high purity alumina into specialised products targeted at more efficient applications within various process technologies within the lithium-ion battery industry. The initiative also offers another potential avenue to secure a portion of future HPA production at a predetermined floor price, which would support project financial close.

Altech's proposed anode grade product range would be produced by Altech's already designed HPA plant in Johor, Malaysia. No new specialised equipment will be required, consequently it is not expected that there will be any material change in the estimated capital cost for the Johor HPA plant from the proposed production of the new products.

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Authorised by: Iggy Tan (Managing Director)

For more information, please contact:

Corporate
Iggy Tan
Managing Director
Altech Chemicals Limited
Tel: +61 8 6168 1555
Email: info@altechchemicals.com

Shane Volk
Company Secretary
Altech Chemicals Limited
Tel: +61 8 6168 1555
Email: info@altechchemicals.com

Investor Relations (Europe)
Kai Hoffmann
Soar Financial Partners
Tel: +49 69 175 548320
Email: hoffmann@soarfinancial.com
Wir sprechen Deutsch.

About Altech Chemicals (ASX:ATC) (FRA:A3Y)

Altech Chemicals Limited (Altech/the Company) is aiming to become one of the world's leading suppliers of 99.99% (4N) high purity alumina (Al2O3) through the construction and operation of a 4,500tpa high purity alumina (HPA) processing plant at Johor, Malaysia. Feedstock for the plant will be sourced from the Company's 100%-owned kaolin deposit at Meckering, Western Australia and shipped to Malaysia.

HPA is a high-value, high margin and highly demanded product as it is the critical ingredient required for the production of synthetic sapphire. Synthetic sapphire is used in the manufacture of substrates for LED lights, semiconductor wafers used in the electronics industry, and scratch-resistant sapphire glass used for wristwatch faces, optical windows and smartphone components. Increasingly HPA is used by lithium-ion battery manufacturers as the coating on the battery's separator, which improves performance, longevity and safety of the battery. With global HPA demand approximately 19,000t (2018), it is estimated that this demand will grow at a compound annual growth rate (CAGR) of 30% (2018-2028); by 2028 HPA market demand is forecast to be approximately 272,000t, driven by the increasing adoption of LEDs worldwide as well as the demand for HPA by lithium-ion battery manufacturers to serve the surging electric vehicle market.

German engineering firm SMS group GmbH (SMS) is the appointed EPC contractor for construction of Altech's Malaysian HPA plant. SMS has provided a USD280 million fixed price turnkey contract and has proposed clear and concise guarantees to Altech for plant throughput and completion. Altech has executed an off-take sales arrangement with Mitsubishi Corporation's Australian subsidiary, Mitsubishi Australia Ltd (Mitsubishi) covering the first 10-years of HPA production from the plant.

Conservative (bank case) cash flow modelling of the project shows a pre-tax net present value of USD505.6million at a discount rate of 7.5%. The Project generates annual average net free cash of ~USD76million at full production (allowing for sustaining capital and before debt servicing and tax), with an attractive margin on HPA sales of ~63%. (Refer to ASX Announcement *"Positive Final Investment Decision Study for 4,500TPA HPA project"* dated 23 October 2017 for complete details. The Company confirms that as at the date of this announcement there are no material changes to the key assumptions adopted in the study).

The Company has been successful in securing senior project debt finance of USD190 million from German government owned KfW IPEX-Bank as senior lender. Altech has also mandated Macquarie Bank (Macquarie) as the preferred mezzanine lender for the project. The indicative and non-binding mezzanine debt term sheet (progressing through due diligence) is for a facility amount of up to USD90 million. To maintain project momentum during the period leading up to financial close, Altech has raised ~A$39 million in the last 24 months to fund the commencement of Stage 1 and 2 of the plant's construction; Stage 1 construction commenced in February 2019 with Stage 2 early works completed at the end of June 2020.