



22 December 2020

## ALTECH – CONFIRMATION OF HPA GRAPHITE PARTICLE COATING TECHNOLOGY

### Highlights

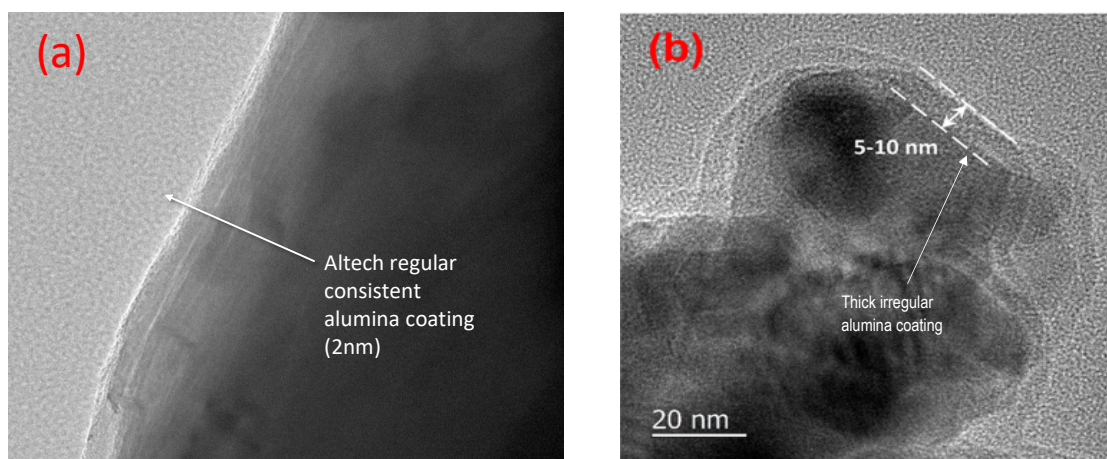
- Successful graphite coating development
- Curtin University & University of Western Australia
- New product development targeting lithium-ion battery anode
- Specially designed formulation and coating process
- Potential improvements to lithium-ion battery life, capacity and chargeability

Altech Chemicals Limited (Altech/the Company) (ASX: ATC) (FRA: A3Y) is pleased to announce the success of an initial demonstration of its technology to coat particles of graphite, typical of those used in anode applications within lithium-ion batteries, with a nano layer of high purity alumina (HPA).

On 23 September 2020, Altech announced that as a result of its ground-breaking research and development work the Company was proceeding to an independent verification phase of its method for the alumina coating of graphite particles. A first phase demonstration was conducted at Curtin University, Western Australia during late November 2020 and resulted in the successful application of a uniform and consistent two to three (2-3) nano-metre (nm) coating of alumina to graphite particles.

The HPA coated graphite particles were examined at the University of Western Australia under a transmission electron microscope (TEM). As seen under the microscope (Figure 1(a), below), a uniform and consistent alumina layer of around 2 nm was observed on the outer edge of the graphite particle – this is Altech's alumina coating technology. The uniformity and consistency of an alumina coating on graphite particles is expected to be critical for improved lithium-ion battery performance. In contrast, figure 1(b) shows that an alumina layer applied via a current coating technique is thicker, irregular and inconsistent.

Figure 1 – Electron Microscope images of alumina coated graphite particles: (a) Altech (b) Current



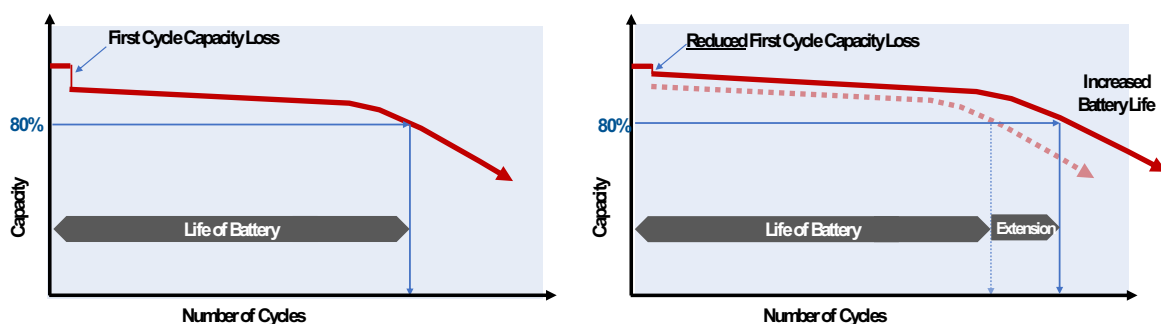
The demonstration of Altech's HPA particle coating technology is a very encouraging development for the Company. The next step will be to advance battery performance trials. These trials will aim to quantify the potential performance and lithium-ion battery life-cycle improvements using Altech's HPA coated graphite anodes.

## 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 2 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 ongoing operation of the battery.

Figure 2 – 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 for significant more efficient application 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.

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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 these new products.

Managing Director, Iggy Tan said that verification of Altech's coating technology is very exciting for the Company. *"We are very encouraged by the near perfect coating results from our technology which has the potential to significantly impact lithium-ion battery performance and address the problem of "first cycle capacity loss". The next stage of work is battery performance testing using our alumina coated graphite, which will aim to demonstrate a step change in battery energy density capacity, performance and battery life," he said.*

– end –

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](mailto:info@altechchemicals.com)

**Shane Volk**

Company Secretary

Altech Chemicals Limited

Tel: +61 8 6168 1555

Email: [info@altechchemicals.com](mailto:info@altechchemicals.com)

**Investor Relations (Europe)**

**Kai Hoffmann**

Soar Financial Partners

Tel: +49 69 175 548320

Email: [hoffmann@soarfinancial.com](mailto: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 (Al<sub>2</sub>O<sub>3</sub>) 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.

**Forward-looking Statements**

This announcement contains forward-looking statements which are identified by words such as 'anticipates', 'forecasts', 'may', 'will', 'could', 'believes', 'estimates', 'targets', 'expects', 'plan' or 'intends' and other similar words that involve risks and uncertainties. Indications of, and guidelines or outlook on, future earnings, distributions or financial position or performance and targets, estimates and assumptions in respect of production, prices, operating costs, results, capital expenditures, reserves and resources are also forward-looking statements. These statements are based on an assessment of present economic and operating conditions, and on a number of assumptions and estimates regarding future events and actions that, while considered reasonable as at the date of this announcement and are expected to take place, are inherently subject to significant technical, business, economic, competitive, political and social uncertainties and contingencies. Such forward-looking statements are not guarantees of future performance and involve known and unknown risks, uncertainties, assumptions and other important factors, many of which are beyond the control of the Company, the directors and management. We cannot and do not give any assurance that the results, performance or achievements expressed or implied by the forward-looking statements contained in this announcement will actually occur and readers are cautioned not to place undue reliance on these forward-looking statements. These forward-looking statements are subject to various risk factors that could cause actual events or results to differ materially from the events or results estimated, expressed or anticipated in these statements.