Media Release
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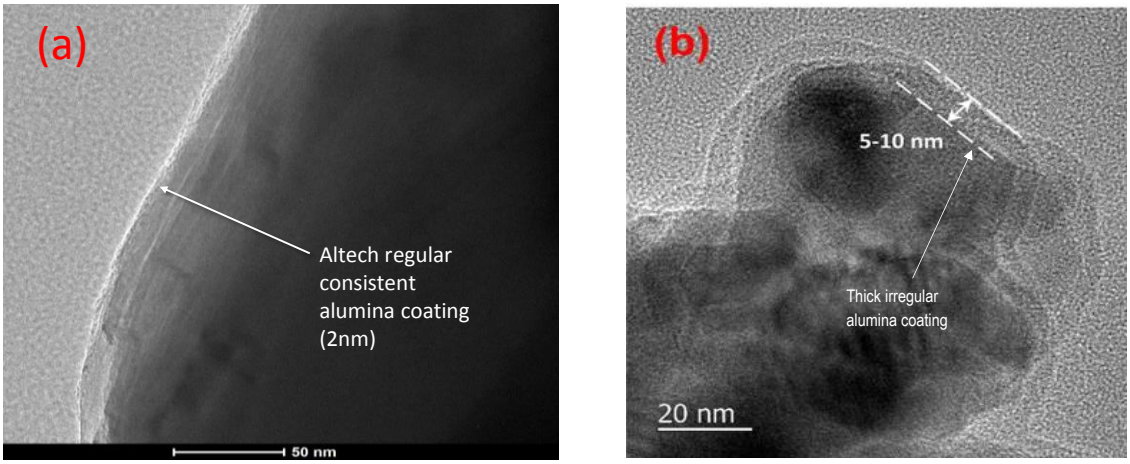
Confirmation of graphite alumina coating technology - key to lithium-ion batteries evolution

Ground breaking research by an Australian high purity alumina (HPA) company has announce the success of an initial demonstration of a new alumina product and technology specifically designed for anode applications within lithium-ion batteries. 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.

Thin layer alumina coating of graphite particles used within the lithium-ion battery anode could be a game changer for the evolution of lithium-ion battery performance. Thin layer coating of alumina on anode graphite particles can measurably improve lithium-ion battery life, capacity and chargeability.

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



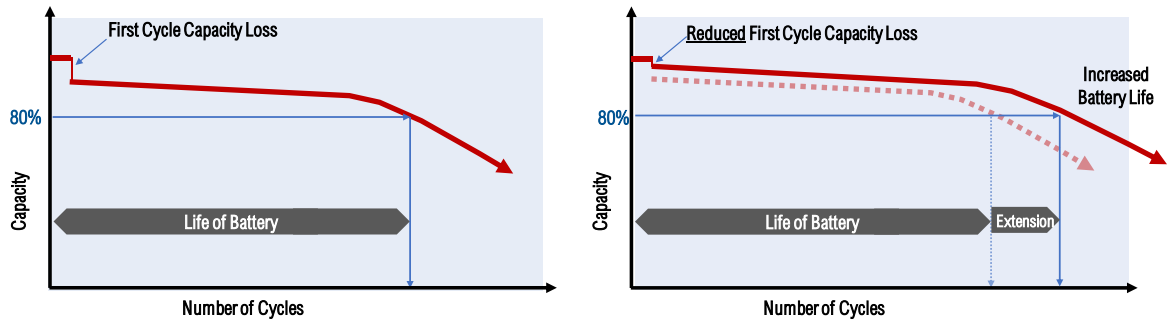
The demonstration of Altech Chemicals' HPA particle coating technology is a very encouraging development for the Company. The next step will be to advance battery performance trials. These trials will aim to quantify the potential performance and lithium-ion battery life-cycle improvements using Altech's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

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.