

June 7, 2021

# PATENT SUBMISSION FOR ALUMINA COATING OF BATTERY MATERIALS

## Highlights

- Successful lodgement of patent for alumina coating technology
- New product development for use in lithium-ion battery anode
- Potential improvements to lithium-ion battery life, capacity and cyclability

Altech Advanced Materials AG (“AAM” / the company) (pta034/07.06.2021/16:00; FRA: AMA1), is pleased to announce that Altech Chemicals Australia Pty Ltd (“Altech”) has announced that it has lodged a with the Australian Patent Office for its invention of methods for coating anode active materials with alumina. The patent describes Altech’s technology for alumina-containing coating. The alumina coating layer, when applied to anode materials such as graphite and silicon would serve as an artificial solid electrolyte interface (SEI), which is expected to reduce lithium-ion losses during each charge and discharge cycle of a lithium-ion battery, and also retard degradation of battery capacity.

On 26 September 2020, AAM has announced that Altech as a result of its ground-breaking research and development work, was proceeding to an independent verification phase of its method for the alumina coating of graphite particles. In these first phase coating trials, Altech demonstrated that it was able to apply very uniform and consistent nano-metre scale alumina coating layers on graphite anode particles. The particles were examined at the University of Western Australia under an electron microscope, where a thin continuous, regular coating of alumina was observed.

A successful first round of battery testing of Altech’s alumina coated graphite has also been completed. For this test, a batch of battery electrodes were produced using non-coated standard anode grade graphite particles (the control), and a separate batch was produced that contained anode grade graphite particles coated with HPA using the Company’s technology. One hundred cycles of cell charge and discharge were completed and results for the coated graphite anodes compared to the non-coated anodes were positive and encouraging.

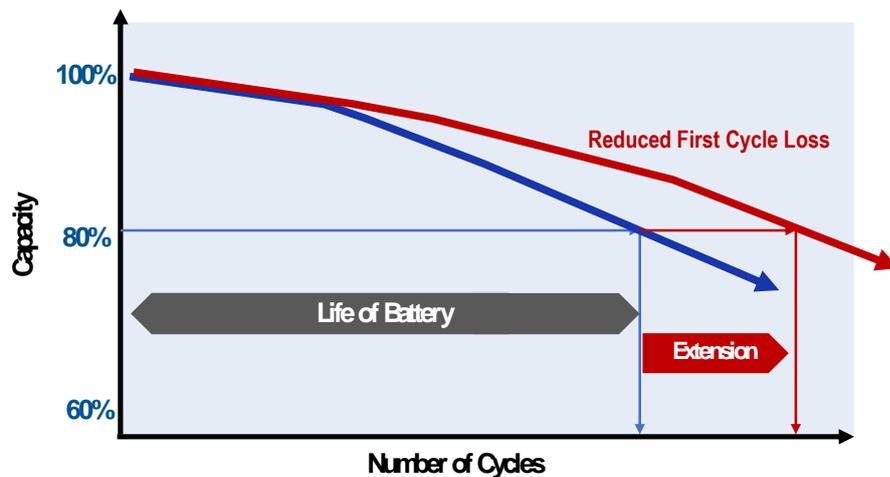
## Background

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 8-10% 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 1 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 1 – Impact of reduced “first cycle capacity loss”



First cycle capacity loss in a rechargeable lithium-ion battery is because of the deposition of lithium ions onto the anode graphite particles within the battery during the initial battery charge 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 very thin layers 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.

The Management Board

#### **About Altech Advanced Materials AG**

Altech Advanced Materials AG (ISIN: DE000A2LQUJ6) (“AAM”) from Heidelberg is a Frankfurt listed investment company. The company's objective is to participate in the market for lithium-ion batteries and thus the rapidly growing electromobility sector, as well as in the expected market development for the other applications of high-purity alumina. For this purpose, Altech Advanced Material AG has taken a 25%-stake in Altech Industries Germany, Dresden, (“AIG”), where a factory for the production of anode battery coating material is planned to be built together with the partner Altech Chemicals Limited, Australia (“ATC”). Currently, the pre-feasibility study is under development. AIG holds exclusive rights to the use of coating technology for anode materials and the rights to the technology for the production of high purity alumina (“HPA”) within the European Union of Altech Australia Pty Ltd, Australia, (“Altech”). Furthermore, AAM holds an option to acquire an interest of up to 49% in Altech Australia Pty Ltd, Australia, (“Altech”) for up to \$100 million. Currently, Altech is a wholly owned subsidiary of ATC. Altech is the owner of the IP rights to the HPA technology as well as the 100% parent company of Altech Chemicals Sn Bd, Malaysia, through which a 4,500 tpy HPA plant is to be built in Johor, Malaysia and Altech Meckering Pty Ltd, Australia, the company that holds the rights to the kaolin mine used to procure the raw material for the production of the HPA. More information at: [www.altechadvancedmaterials.com](http://www.altechadvancedmaterials.com)

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