ASX: **A4N**
ASX Announcement
27 July 2021

The Manager Companies
ASX Limited
20 Bridge Street
Sydney NSW 2000

REPORT ON ACTIVITIES FOR THE QUARTER ENDED 30 JUNE 2021

HIGHLIGHTS

PRECURSOR PRODUCTION FACILITY (PPF) STRATEGY

- **Fast-track commercialisation of the Company's two ultra-high purity precursor products**
- **Facility to be built on HPA First Project site in Gladstone**
- **$27M capex fully funded after successful completion of $50M placement**
- **First production expected in July/August 2022**

GLOBAL MARKETING PARTNERS IN PLACE

- **MoU with APL Engineered Materials to market Alpha's products to Japanese and Chinese markets**
- **MoU with Technologica to market Alpha's products to Europe**
- **MoUs complement existing marketing activities and expand geographical reach**

PRODUCT MARKETING ACCELERATES

- **Significant additional inbound interest in the Company's precursor products since PPF strategy launch**
- **First commercial HPA sales to a German LED phosphor counterparty**
- **Additional 93kg of Al-nitrate sales (Al-precursor #1)**
- **26 product test orders received and/or shipped in the quarter**
- **Over 60 test orders despatched in total to over 35 end-users**

MEMORANDUM OF UNDERSTANDING WITH CLEANCO QUEENSLAND

- **Potential to supply 100% of the HPA First Project electricity demand with renewable energy**
- **Carbon footprint modelling of the HPA First project indicates a 59% reduction in CO2 emissions over incumbent HPA manufacturing processes**

HPA FIRST PROJECT WORKSTREAMS ADVANCED

- **Worley awarded the HPA First Project Front End Engineering and Design (FEED) and also nominated as preferred ePCM contractor**
- **Water supply contract signed with Gladstone Area Water Board**
- **Orica Definitive Agreements scheduled for execution in late July/early August**
- **Stage 1 of the Lender Engineer's Independent Technical Expert (ITE) review completed**

Commenting on June quarter activities, Managing Director Rimas Kairaitis, said

"The quarter has been transformational for Alpha. The Company is now set to enter commercial production via the PPF next year, and is accelerating each of the workstreams on the full scale Project"

OPERATIONS REVIEW

Activities in the June 2021 quarter were headlined by the roll-out and funding of the Company's Precursor Production Facility (PPF). The PPF strategy represents the fast-track commercialisation path to the production of the HPA First Project's two ultra-high purity aluminium precursor products, being Aluminium Nitrate and Aluminium Sulfate. The formation of this strategy gathered significant momentum during the quarter on the back of increased product demand and the Company announcing a series of strategic Memoranda of Understanding (MoUs) with selected marketing agents across likely products markets of Japan/China and Europe.

The Company has also made strong progress on numerous supporting activities to the full scale HPA First Project, including the appointment of Worley as FEED study managers and preferred ePCM contractors, securing water supplies, a renewable energy supply MoU with CleanCo Queensland, the acceleration of Project land acquisition, product marketing activities and project financing. Further details on these developments are outlined below.

PRECURSOR PRODUCTION FACILITY

The PPF strategy will capitalise on growing customer interest for the Company's suite of high purity (5N) aluminium precursor products and accelerate production and revenue from the HPA First Project. The PPF will provide Alpha with the opportunity to fast-track project cash flows, build market share, strengthen relationships with key customers and establish a reputation as a premium producer of high purity aluminium products ahead of the full scale HPA First Plant, whilst not interrupting the full scale Project schedule.

The PPF will be allow Alpha to service end-users seeking precursor supply that is immediately available. The market for Alpha's precursor products is rapidly evolving, with numerous end-user supply chains are actively seeking new sources of near term supply, particularly from low carbon, ESG friendly sources.

Further detail on the Company's high purity (5N) aluminium precursor products are included as Appendix 1.

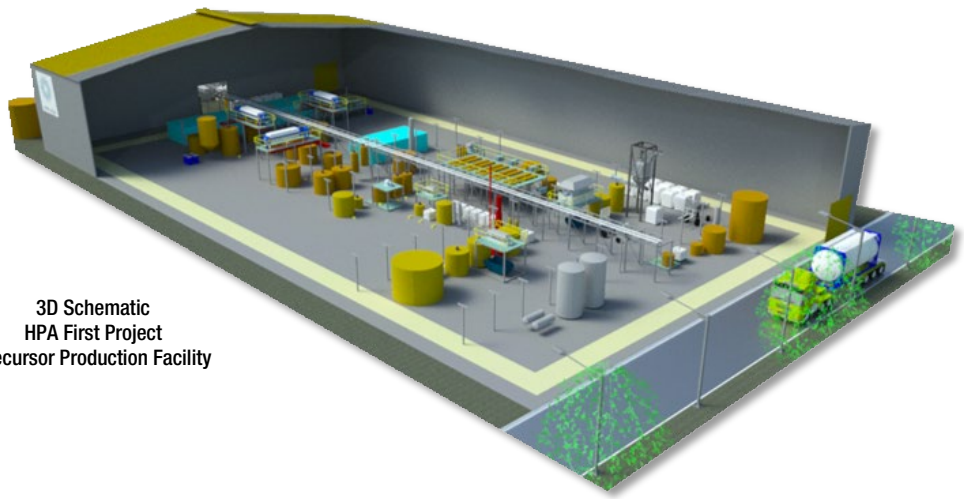
Design and Production Capacity

The PPF design and production estimates have been built up from the process mass balance and have been incorporated into the existing HPA First Project design.

The PPF will have production capacity of:

- 200 tonnes per annum (~17 tonnes per month) of either Precursor #1 (Al-nitrate) or Precursor #2 (Al-sulfate or cathode precursor), with product mix to be determined by customer orders. Further details on the Company's precursor products are provided below; and
- 3 tonnes per annum of high purity boehmite or 2 tonnes of high purity alumina for both pre-commercial orders and/or product development.

Once the full scale HPA First Plant is commissioned, the PPF will be used exclusively for the manufacture of >200tpa of Precursor #2 (cathode precursor), converting a high purity aluminium feed directly from the full scale HPA First Project.



3D Schematic
HPA First Project
Precursor Production Facility

Orica PPF Agreement

As a key component of the PPF strategy, Alpha reached agreement with Orica Australia Ltd ('Orica') with respect to the supply of key process reagents and the offtake of process by-product ('Orica PPF Agreement'). The Orica PPF Agreement is based on the final draft of the Definitive Supply and Offtake Agreement for the full scale HPA First Plant, with an amendment that the PPF reagents and by-product will be delivered by truck load-out until the proposed pipe connections are in place. Costs of truck delivery and offtake will be borne by Alpha.

PPF Feedstock

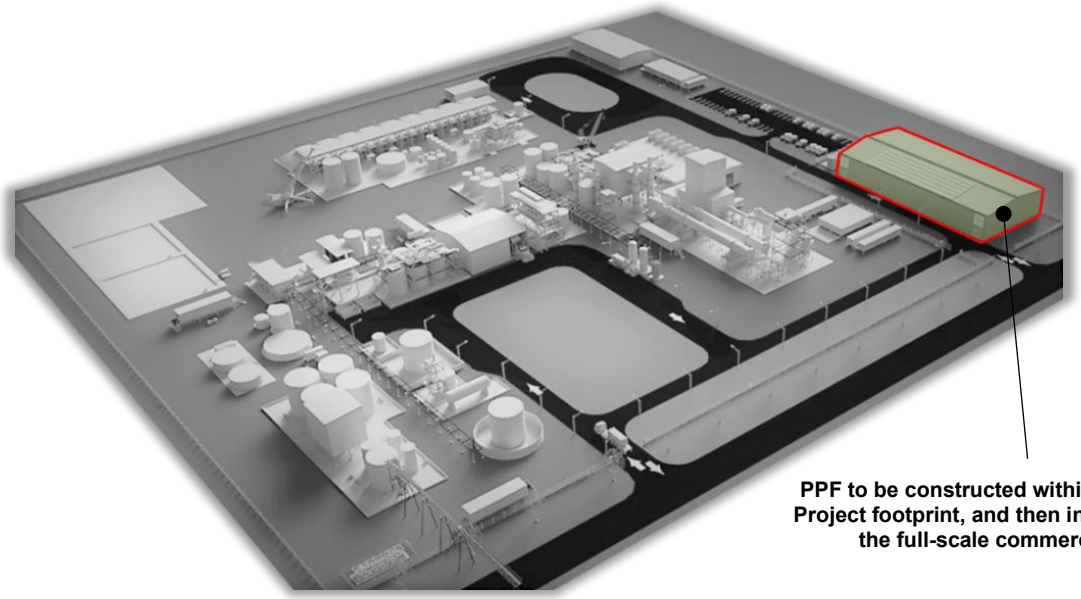
Alpha will continue to source feedstock for the PPF from the same feedstock supplier to the Brisbane Demonstration Plant.

Location and Permitting

The PPF will be constructed within the Gladstone State Development Area (GSDA) on the existing 10 hectare plot of land the Company has optioned (Lot 12/SP239343) adjacent to Orica's Yarwun refinery. Following consultation with the relevant Queensland Government agencies, the PPF will be able to be constructed with only minor amendments to the existing MCU approval (Development Permit) received from the Queensland State Government in February 2021.

AECOM Consultants have been engaged and have commenced the amendment process. The amendment documentation, together with the combined Environmental Authority application, is due for lodgement in July 2021, with an anticipated approval in the December quarter 2021.

Alpha has also engaged with Economic Development Queensland and commenced the minor contract changes with respect to the land contract relating to Lot 12/SP239343.



PPF to be constructed within the HPA First Project footprint, and then incorporated into the full-scale commercial plant.

EPCM and Construction Timeframe

Alpha has engaged Prudentia Process Consultants ('Prudentia'), principal engineers to the HPA First Project, to deliver the 12-week Front End Engineering and Design (FEED), ahead of the Engineering, Procurement and Construction Management (EPCM) for the PPF. Alpha and Prudentia have been working closely on the HPA First Project since 2017, with Prudentia authoring both the Pre-Feasibility Study (March, 2019) and the Definitive Feasibility Study (March, 2020) for the Project.

Prudentia's established working knowledge of the process and their wider expertise on delivering SX based process solutions makes them ideally suited for the EPCM of the PPF. It is the intention of the Company to begin construction of the PPF in Q4 FY 2021, with commercial production scheduled for July/August 2022.

The PPF will not impact the proposed schedule for the full scale HPA First Plant, which will be constructed around the PPF (refer graphic above), with the PPF then used exclusively for the manufacture of Precursor #2 (cathode precursor), converting a high purity aluminium feed directly from the full scale HPA First Plant. The PPF will then be linked into the full-scale utilities, reagents and process control.

Since the being appointed as principal engineers to the PPF, Prudentia have advanced the following key FEED workstreams

- Finalisation of process design criteria and mass balance.
- Generation of key plant design criteria and preparation for reagent/product logistics.
- Preparation of key long lead equipment specifications for procurement.
- Design of plant fabrication modules and layouts.

Technology Licensing Agreement

Alpha has reached agreement with its IP/technology licensors to modify the licence agreement to accommodate the additional production from the PPF. Alpha will pay a 2% gross revenue royalty on PPF product sales and a $50,000pa licence fee.

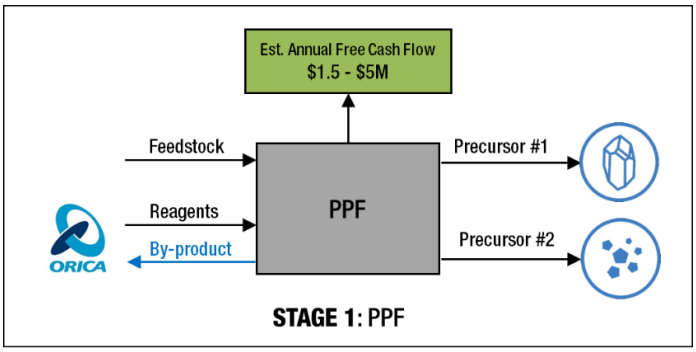
Precursor Production Facility – Project Metrics

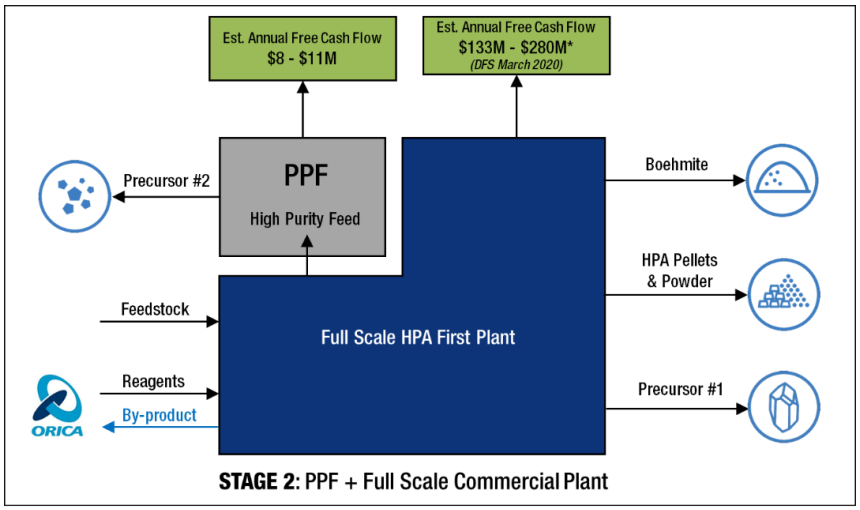
The PPF is designed to immediately deliver positive cash flows from precursor sales, to build market share, strengthen relationships with key customers, and to establish a reputation as a premium producer of high purity aluminium products ahead of the Full Scale HPA First Plant.

- The PPF CapEx estimates have been built up by Prudentia and total $27.6M.
- The PPF OpEx estimates have been built up by Prudentia from the existing HPA First Project cost database and the Orica PPF Agreement and total $9.7M pa.
- The PPF is initially expected to generate initial free cash flow of between $1.5M - $5M pa.

Once the full scale HPA First Plant is in place:

- The PPF will focus exclusively on Precursor #2 (cathode precursor) processing a high purity aluminium feed directly from the Full Scale HPA First Plant with an enhanced capacity of +200tpa.
- The majority of the PPF fixed costs will be transferred to the full scale HPA First Plant, and the variable costs (reagents, utilities etc) will fall to ~$0.1M pa. The full scale HPA First Plant will take on the duty of the manufacture of Precursor #1.
- The free cash flow from the PPF will increase to between $8M - $11M pa, in addition to free cash flows generated from the full-scale facility. This will increase significantly as Precursor #2 production increases above 200tpa.





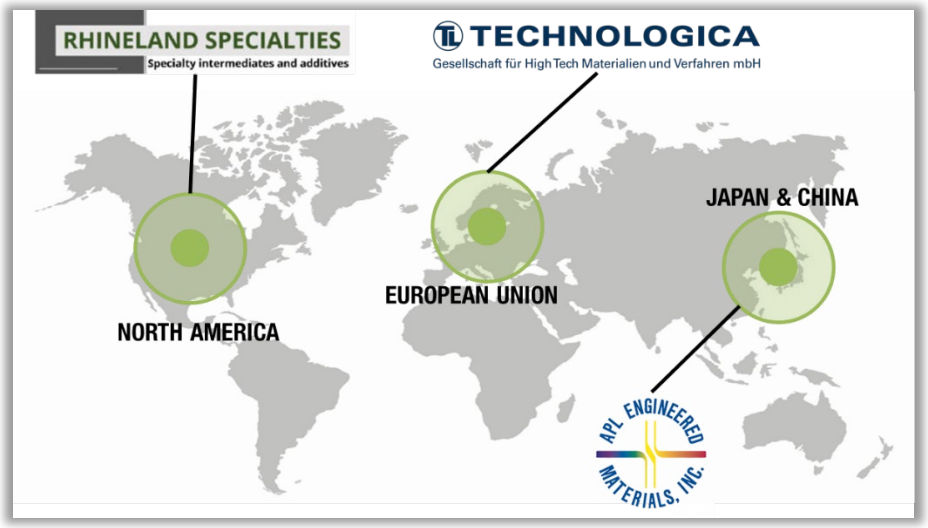
Precursor Sales and Marketing

Alpha's PPF strategy has been based on feedback from a network of marketing arrangements covering the key technology jurisdictions of North America, Japan, China and the European Union (EU) via a series of MoUs with marketing counterparties focusing on specialty market applications. These counterparties include:

- North America - via Rhineland Specialties (ASX announcement: 25 November 2020);
- Japan and China - via APL Engineered Materials, (ASX announcement: 28 April 2021); and
- European Union - via Technologica (ASX announcement: 3 May 2021).

Each of the MoUs has been designed with a particular focus on marketing Alpha's high purity aluminium precursor products and to complement existing marketing and distribution arrangements with Traxys and the Company's various direct end-user engagements.

Each of these arrangements allows for Alpha's products to access a range of high value specialty applications and markets.



Alpha has established a global network of marketing counterparties to access high value specialty markets

FULL SCALE HPA FIRST PROJECT

The June quarter saw the Company make strong progress across several key workstreams relating to the planning, development and commercialisation of the full-scale the HPA First Project. Material developments are outlined below.

MoU with CleanCo Queensland

During the quarter Alpha signed an MoU with CleanCo Queensland Limited (CleanCo) with respect to co-operation towards negotiating a Renewable Energy Supply Agreement (REA) for the HPA First Project.

Under the MoU, Alpha and CleanCo will consider a range of potential supply agreements underpinned by low-emission and renewable power generation from CleanCo's existing generation portfolio, as well as renewable projects under construction, which have capacity to supply the HPA First Project with 100% of its electricity demand backed by renewable energy.

A successful REA would further reduce the HPA First Project's already low carbon footprint.

Carbon Footprint Modelling

An updated model of carbon-dioxide (CO_2) emissions for the proposed HPA First facility, under a range of renewable energy supply scenarios, has been completed by Prudentia. The model accounts for all direct CO_2 emissions and also accounts for N_2O as CO_2 equivalent emissions.

Key outputs of the model are shown in the table below, with the highlight outcome:

- Using 100% renewable energy, the HPA First Project represents a 59% reduction in CO_2 emissions, per unit of HPA produced, over the incumbent HPA manufacturing process (Alkoxide Process).

Item	Tonnes CO_2 per tonne HPA	
Incumbent alkoxide process	12.44	
		CO_2 Reduction
HPA First Project - process baseline	9.54	22.4%
HPA First Project - 50% renewable electricity purchase	7.29	41%
HPA First Project - 100% renewable electricity purchase	5.04	59%

The model has been constructed on a 100% high purity alumina production basis. The pending adoption of additional high purity products into the Project mix, inclusive of the 2 high purity Al-Precursors and boehmite, would further reduce the Project CO_2 emissions, due to the reduction in drying and calcination duty.

Worley nominated as preferred ePCM contractor and awarded the HPA First Project FEED

Alpha elected to nominate Worley Services Ltd (Worley) as preferred ePCM contractor to the HPA First Project. Worley's strong project delivery team and presence in Gladstone was a major consideration with the Company believing Worley have the right mix of experience and capabilities to successfully deliver the HPA First Project.

In addition, Alpha and Worley have executed an interim agreement for the commencement of the full scale HPA First Project Front End Engineering and Design (FEED).

The FEED Scope of Work includes:

- Developing of key documentation for use in detailed design.
- Updating the study documentation with the aim to accelerate detailed design, drawings, and documentation.
- Completing a project layout review.
- Seeking formal tenders for long lead (or critical) equipment packages.
- Updating the Cost Estimates to current pricing.
- Performing project delivery planning.

Water supply contract signed with Gladstone Area Water Board

Alpha has executed a water supply contract with Gladstone Area Water Board (GAWB) for the PPF and the HPA First Project.

The contract sets out the terms and conditions for:

- Supply of potable water for the PPF and administration office.
- Supply of non-potable/raw (process) water for the HPA First Project.

The water supply under the contract does not start until certain conditions (including construction of necessary connecting water infrastructure) are met. The parties are currently working through the conditions together so water supply can start in accordance with the agreed timeline.

Orica Agreements Update

Alpha and Orica Australia Pty Ltd (Orica) have negotiated agreements for the supply of process reagents to the HPA First Project from Orica's Yarwun facility within the GSDA, and the return offtake of process by-product.

In summary the agreements comprise:

- A Project Implementation Agreement (PIA) where the PIA describes the capital investment obligations of the parties and the scope for project commissioning and reagent and by-product validation trials.
- A Supply and Offtake Agreement (SOA) which describes the pricing, volume and product delivery of the process reagents and the process by-product, as well as the technical details of by-product management and QA/QC protocols.
- A Products Pre-Pay arrangement.

Orica and Alpha anticipate signing the contracts in late July or early August.

Gladstone Land Contract

The Company is now working with Economic Development Queensland (EDQ) on the finalisation of the remaining conditions precedent to the land contract, in respect of the HPA First Project site within the GSDA, to allow for contract settlement in the September 2021 quarter.

Stage 1 of the Lender Engineer's (ITE) review complete

In May 2021, Alpha appointed RPM Advisory Services (RPM) as Independent Technical Expert (ITE) to the potential lenders to the HPA First Project. RPM has now completed Stage 1 of the ITE review process, being the review of the HPA First Project process, the demonstration plant and process validation. RPM have now issued a 'Red Flag Report' of its key initial findings.

Alpha notes the Red Flag Report identified no fatal flaws with all identified risks, after mitigation steps, considered to be low.

Project Financing Update

During the quarter, Alpha continued working actively on the HPA First Project financing with support from its advisors (KPMG DAT). The Company is seeking to debt fund a substantial component of the HPA First Project CapEx from a combination of Australian Commonwealth Government lenders and commercial banks. Alpha and KPMG are servicing a range of due diligence requests, including technical (see ITE update above), legal and commercial requests.

The Company is very encouraged by the level of interest in the HPA First Project financing and in the funding interest in the de-carbonising sector generally.

PRODUCT MARKETING

During the June quarter, Alpha continued to advance its marketing effort across its full range of high purity alumina and aluminium products, spanning a diverse range of end-users and applications, as both direct engagements and via intermediaries. The Company remains extremely pleased with the level of end-user engagement across its suite of ultra-high purity aluminium products, which continue to progress towards commercial end-user supply arrangements. Alpha's Brisbane facility is continuing to manufacture and ship test samples for product assessment, and to service product sales into specialty markets.

- 26 product test orders received and/or shipped in the quarter
- Alpha's product marketing has now despatched over 60 test orders to over 35 end-users

Product marketing highlights for the quarter include:

- **First commercial HPA sales to a German LED phosphor manufacturer:** Following product qualification, Alpha has sold an initial 25kg of HPA powder @ US$435/kg. This order represents an important validation of Alpha's product development for application in LED phosphor manufacture.
- **Further sales of Al-Precursor #1 (Al-Nitrate):** During the quarter Alpha received further sales orders for 93kgs with a further +20kg despatched for testwork by 4 separate end-users.
- **Further product delivery to Saint Gobain:** Alpha has now delivered 13 product samples to Saint Gobain with a further 3 products under manufacture at the end of the quarter.
- **Further boehmite orders from Japan based separator manufacturer:** In May Alpha received 2 new boehmite product orders from a Japan based manufacturer of coated lithium-ion battery separators. This order follows the delivery of initial boehmite product sample in 2020.
- **High density sintered pellets under production for Japanese ceramics business:** In December 2020, Alpha completed the successful delivery of 96kg of sintered pellets to AlOx technology (AlOx). AlOx then subsequently grew a ~90kg sapphire boule that was successfully wafered and qualified for optical applications. Building from this testwork, Alpha is currently manufacturing a 20kg sample order of bespoke, high density HPA pellets for a large Japan based ceramics and sapphire glass manufacturer.

- **10 product samples requested and/or shipped to clients of APL:** During the quarter Alpha received 10 products samples via APL (Japan), including various alumina powders and Al-nitrate. All product orders were received from the LED lighting sector, including product orders from one of the largest global manufacturers of LEDs and LED phosphors.

- **Product samples requested and/or shipped to clients of Technologica:** Market outreach into specialty technology markets in the European Union (EU) via the marketing MOU with Technologica commenced in the quarter, with Alpha shipping test products for application in specialist ceramics and LED lighting.

- **Lithium-ion battery cathode manufacturers:** Alpha remains in dialogue with a range of lithium-ion battery cathode manufacturers, both directly and through intermediaries with regard to our high purity (5N) aluminium cathode precursor (Al-sulfate).

- **Lithium-ion battery separator manufacturers:** In the quarter, Alpha received, and have now delivered a further 4 alumina product samples for lithium-ion battery coating applications to USA based manufacturers.

Recent high-purity product products shipments from Alpha's

51kg 5N Al-nitrate sales order (USA)

100kg Alpha HPA pellets for sapphire glass manufacture AIOX technology (USA)

25kg HPA sales order to German LED phosphor manufacturer

PRODUCT DEVELOPMENT

In addition to the ongoing product outreach, Alpha maintains a continuous process of product development and process improvement. This is driven both by end-user feedback and leveraging the considerable process expertise within the Company.

Alpha continues to receive inbound end-user requests for new product development. Alpha's process flexibility, and continued operation of the Brisbane demonstration facility, provides the opportunity to rapidly adjust process conditions to deliver new product specifications.

Alpha is very selective on new product development requests and is careful to allocate product development resources only in circumstances where there is a clear commercial benefit on a successful outcome.

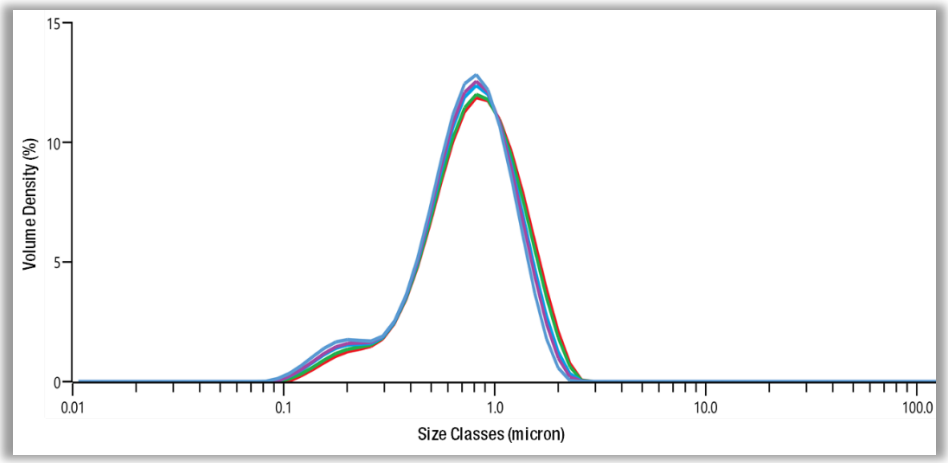
The Company has recently received 4 inbound product developments requests, related to specific, high value aluminium products for specific end-user applications.

‘Battery grade’ HPA powder particle sizing achieved without milling

The dominant application of HPA (by volume) within the lithium-ion cell is the in the single or double-sided layer coating of battery separators with HPA (ceramic coated separators, or CCS). This application generally requires HPA powders with a particle size distribution (PSD) of between 0.1 and 2.1 micron, to allow smooth layer coats of 4 to 8 micron thickness. This PSD is achieved by Alpha and existing manufacturers utilising a jet milling step, with bespoke milling settings to achieve the desired PSD.

Alpha has confirmed that through a key process improvement in the HPA Precursor step, the Company can now achieve ‘battery grade’ PSD without jet milling. Particle sizing from unmilled, static calcined HPA material manufactured in the Brisbane facility is presented in graphic form below. This process change has now been implemented at demonstration plant scale.

The removal of jet milling for the manufacture of battery grade HPA powder is considered a very positive process development and is expected to translate into significant capital and operating cost savings. In addition, removal of jet milling for battery HPA removes a process step which usually introduces small levels of impurities.



‘Battery grade’ particle sizing distribution for alpha form HPA powder, achieved without jet milling

Low surface area aluminas

In response to a high-value, high volume inbound enquiry from a large European manufacturing business, Alpha is adapting its process to manufacture a specific, low surface area alumina morphology.

Specialty boehmite

Based on inbound requests, Alpha is developing a high-value specialty boehmite product for application in various coating products (including lithium-ion battery cathodes) and for use as a precursor for specialty aluminas.

Engineered aluminas

Alpha has been working with a German based LED phosphor manufacturer on an adapted process to manufacture high-value ‘engineered’ alumina with a specific, narrow particle sizing, without any product milling step. In recent weeks Alpha has received a further 2 inbound product enquiries which can be readily met with the process under development.

CORPORATE

Placement raises $50M

Subsequent to announcing its PPF strategy the Company successfully completed a $50M placement (before costs) by the issue of 90.9 million shares to institutional and sophisticated investors. Funds raised will enable the construction and delivery of the PPF, the fast-tracking of long lead items for the full-scale commercial facility and for general working capital purposes.

The placement was completed at $0.55, representing an 11.3% discount to last close and a 13.3% discount to 5-day VWAP and was executed within the Company's existing placement capacity in accordance with ASX Listing Rule 7.1.

Bell Potter Securities Limited and Euroz Hartleys Limited acted as Joint Lead Managers.

The placement was well supported by existing shareholders and a number of new institutional investors, including ESG focused funds, in recognition of the Company's suite of high purity aluminium products for key de-carbonising technologies, and the Company's low-carbon production footprint.

Use of Funds	$M
PPF Construction including contingency	27.6
FEED Study – Full Scale Commercial Facility	1.0
Long lead Items – Deposits and Vendor Packages	2.5
HPA First Project - Land Acquisition	2.5
General working capital	16.4
TOTAL	50.0

Related Party Expenditures

During the June quarter the aggregate amount of payment to related parties and their associates totalled $293,000 comprising $197,000 of payments to Directors or Director related entities for Directors' consulting fees and $96,000 in fees were paid to MIS Corporate Pty Limited ('MIS'), an entity in which Directors Norman Seckold and Peter Nightingale have a controlling interest. MIS provides full administrative services, including administrative, accounting and investor relations staff both within Australia and Indonesia, rental accommodation, services and supplies, to the Group.

COLLERINA PROJECT – NSW (100% Alpha and subject to commodity split agreement)

In line with the Company's plans to focus on advancing the HPA First Project, no exploration activities were undertaken by the Company at the Collerina project during the quarter.

WONOGIRI PROJECT – INDONESIA (45% Alpha, subject to Conditional Share Purchase Agreement)

As previously advised, Far East Gold Limited ('FEG') has now taken over the management and funding of the Wonogiri Project and is required to fulfil a number of conditions to satisfy completion of its acquisition of Alpha's 45% interest in the Project.

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About the HPA First Project

The Company's HPA First Project represents the commercialisation of the production of ~10,000tpa equivalent of high purity alumina (HPA) and related products using the Company's proprietary licenced solvent extraction and HPA refining technology. The technology provides for the extraction and purification of aluminium from an industrial feedstock to produce 4N (>99.99% purity) alumina for the intended use within the lithium-ion battery and LED lighting industry. Alpha completed Definitive Feasibility Study (DFS) in March 2020 following a successful pilot plant campaign in 2019. Alpha has since upscaled its Brisbane facility to demonstration scale and has now recorded over 2,000 operating hours delivering an expanded range of high purity product to over 50 end-users globally.

Alpha is fully funded to the commercial production at its Precursor Production Facility ('PPF') which is scheduled to commence commercial production for the Company's high purity Aluminium Precursors from August 2022.

The Company is now in the mature phases of project permitting, market outreach and project financing processes with respect to the full scale HPA First Project, with the expectation of positioning the HPA First Project to Final investment Decision.

Forward Looking Statements

This report contains certain forward-looking statements with respect to the financial condition, results of operations, business of the Company and certain plans and objectives of the management of the Company. These forward-looking statements involve known and unknown risks, uncertainties and other factors which are subject to change without notice and may involve significant elements of subjective judgement and assumptions as to future events which may or may not occur. Forward-looking statements are provided as a general guide only and there can be no assurance that actual outcomes will not differ materially from these statements. Neither the Company nor any other person give any representation, warranty, assurance or guarantee that the occurrence of the events expressed or implied in any forward-looking statement will actually occur. In particular, those forward-looking statements are subject to significant uncertainties and contingencies, many of which are outside the control of the Company. A number of important factors could cause actual results or performance to differ materially from the forward looking statements. Investors should consider the forward looking statements contained in this report in light of those disclosures.

APPENDIX 1 - 5N PURITY ALUMINIUM PRECURSORS

Alpha has developed and built a robust process for the manufacture of ultra-high purity (5N) aluminium precursor salts. Alpha's proprietary aluminium purification process allows for the production of 5N purity precursors from a comparably low priced and widely available industrial chemical feed.

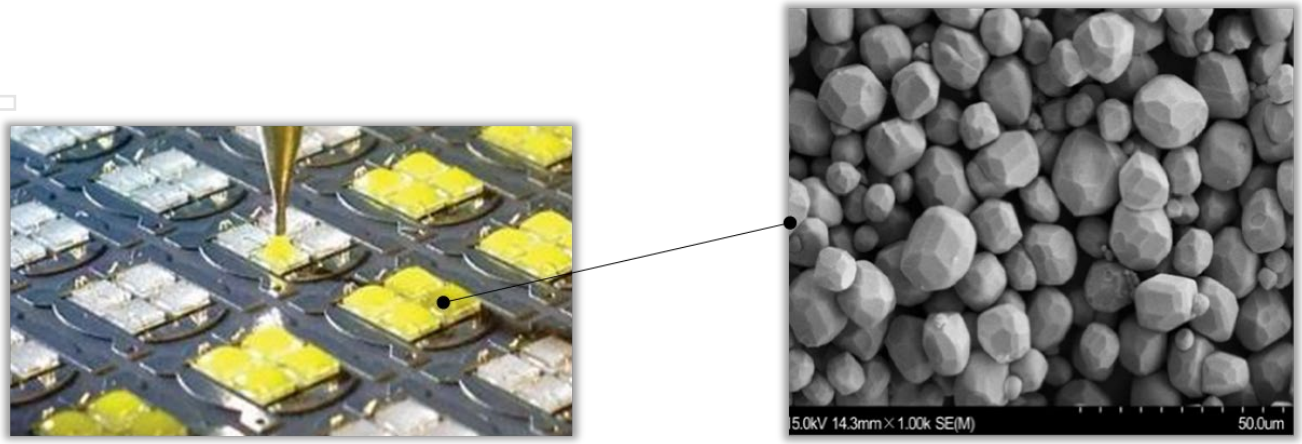
Alpha's precursor manufacturing method represents a significant cost and purity disruption to the incumbent process for these precursor salts which involves a feedstock of 6N refined aluminium metal and purified acids.

5N Al-Nitrate (Al-Precursor #1): $(Al((NO_3)_3).9H_2O)$

Through direct market engagement, and through its various marketing intermediaries, Alpha has identified significant existing demand, as well as supply constrained demand for this 5N precursor for the following applications:

Technology	Application
Specialised Coatings	• Speciality Electronics • Film Coatings
Li-B batteries coatings	• For high purity alumina coating of anode particles • For high purity alumina coating of cathode particles
LED Phosphor Synthesis	For synthesis of ultra fine grained aluminate phosphors (eg: Ce-YAG, LuAG) for mini-LED's and micro-LED's
Optical Scintillators	• Medical imaging scintillators • YAG laser crystals
Other	• Dielectrics • Photovoltaics • Nanomaterials

Of these applications, the application of Al-Precursor #1 in the synthesis of nano-sized YAG phosphor particles for mini-LEDs and micro-LEDs is considered the most prospective, based on the forecast growth of micro-LEDs in particular. Ce-YAG, represents the most abundant LED phosphor globally, and is routinely applied to Ga-N LEDs to down-convert blue light to the white light LEDs as perceived by the human eye (*refer graphic below).*

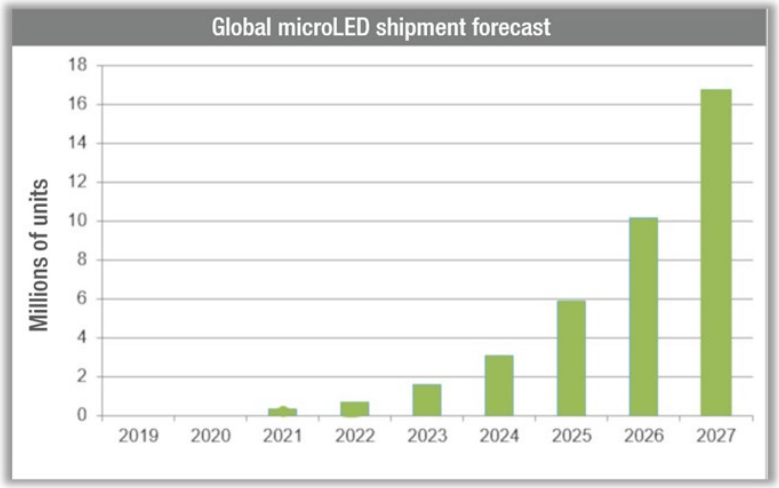


Addition of YAG phosphors to LED lighting circuits

SEM of YAG (Yttrium-Aluminate-Garnet)

Graphic: Application of Ce-YAG to Ga-N LEDs to in the manufacture of white light LEDs

The increasing growth of mini-LEDs and micro-LEDs requires the corresponding reduction in LED phosphor particle grain size. This requirement has seen the increasing utilisation of the wet-process, co-precipitation method for the manufacture of aluminate phosphors using Al-Precursor #1. This process allows for finer particle sizing, required for high efficiency mini and micro-LEDs.

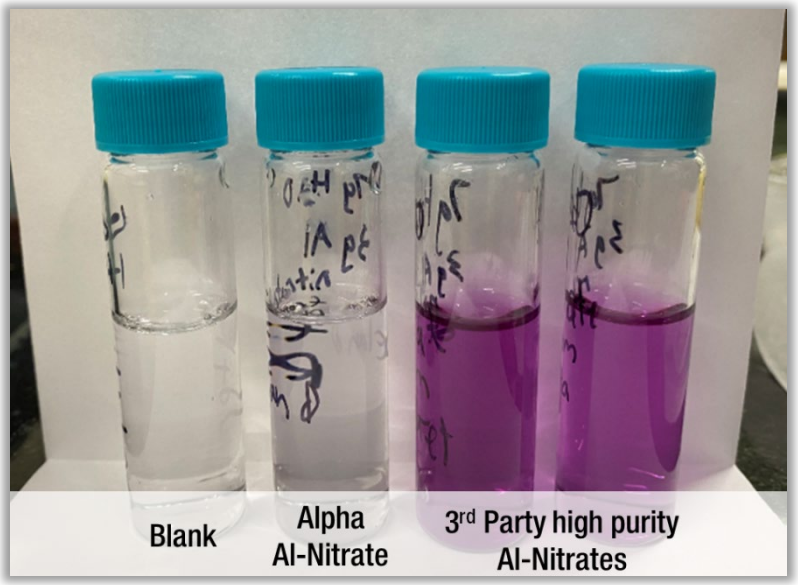


Graphic: Forecast growth in micro-LEDs to 2027
Source (www.microled-info.com)

Key market feedback on Alpha 5N Al-Nitrate (Al-Precursor #1)

Key market feedback from existing and prospective customers to date includes:

- The Alpha Al-precursor#1 represents the highest purity product tested.
- The Alpha product contains **zero detectable iron**, and **zero detectable colour impurities** (see below). These observations are a key positive discriminator for any optical applications including LED phosphors and scintillators.
- Very high purity product demand is substantially supply constrained.

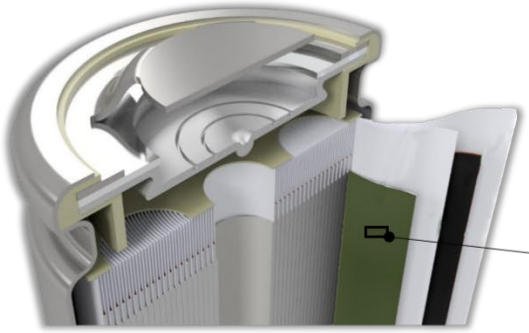


3rd party testwork showing the absence of colour impurities in Alpha's Al-nitrate in comparison to competitor products

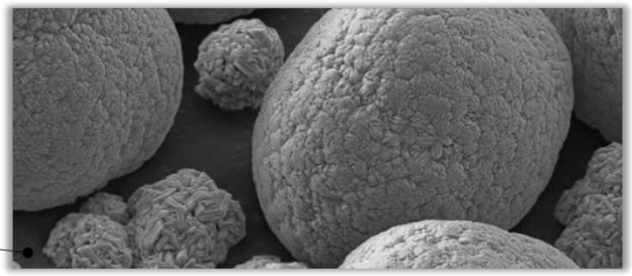
5N Al-Sulfate (Al-Precursor #2): ($Al_2((SO_4)_3).xH_2O$)

Alpha's Al-Precursor #2 has been developed specifically to service the growing adoption of aluminium bearing cathode chemistries within high power lithium-ion batteries (Li-Bs).

Li-B cathodes active materials ('CAM') are manufactured from mixed metal sulphate solutions using the co-precipitation method. The increasing adoption of high-nickel cathode chemistries has seen a corresponding increased demand for high purity nickel-sulphates as the key nickel precursor. In the same manner, increasing adoption of aluminium bearing CAM (notably NCA and NCMA chemistries) builds corresponding demand for high purity aluminium-sulphate as the key aluminium precursor.

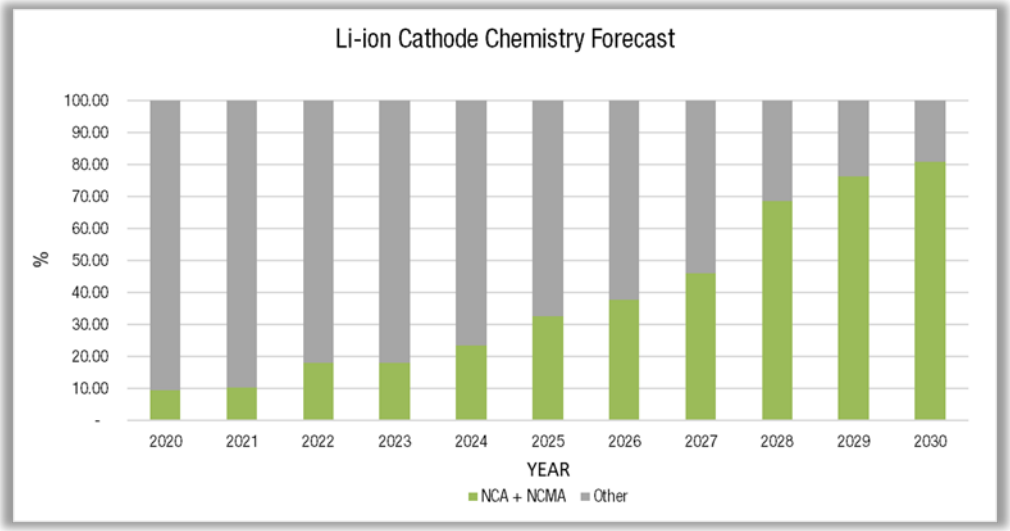


Lithium-ion battery breakaway



SEM of NCA Cathode Active Materials (CAM)

The incorporation of aluminium into the CAM plays a key role in the physical stabilisation of the CAM and improved aging performance of the lithium-ion battery. Cathode chemistry forecasts from UBS (December 2020) shows aluminium bearing cathode chemistries representing 80% of all EV cathode chemistries by 2030 (see graphic below).



NCA + NCMA Cathode Chemistries ~80% by 2030
Source: UBS – Dec 2020

Alpha's recent production batches of Al-Precursor #2, using improved process conditions, resulted in an upgraded product purity to beyond the detection levels of the third-party analytical techniques (ME-ICPMS), recording <1ppm total impurities.

Alpha is not aware of comparable purity levels for this product globally.

The Company is now in the early stages of market outreach to targeted CAM manufacturers. Similar to feedback received on the Al-Precursor #1, it is apparent that live demand is considerably influenced by immediate product availability, providing a key motivation for Alpha to proceed with the PPF.