TAO COMMODITIES

ASX RELEASE | ASX:TAO

15 February 2021

TAO TO EXPLORE COMMERCIALIZATION OF LOW-CARBON, LOW-COST TITANIUM METAL POWDER IN THE USA

- Research agreement and option for exclusive license signed to develop titanium metal powders using the breakthrough **HAMR technology** invented by Dr. Z. Zak Fang and his team at the University of Utah with funding from ARPA-E, with Boeing and Arconic (formerly Alcoa, Inc.) as industrial partners.
- ARPA-E is a U.S. Department of Energy agency which funds transformational advanced energy technology projects which have included solid state EV battery company Quantumscape (NYSE: QS).
- The **HAMR technology** has demonstrated the potential to produce titanium powders with;
  - Low-to-zero carbon intensity
  - Significantly lower energy consumption
  - Significantly lower cost
  - Product qualities which exceeds current industry standards
- TAO's potentially large scale titanium deposit at the Titan Project in Tennessee – coupled with development of **low-to-zero carbon, low-cost titanium powders** – builds a platform for TAO to become an integrated leader in the titanium supply chain for high growth sectors such as;
  - Space exploration
  - Aerospace
  - Electric vehicles
  - Defense
- The Company has established a commitment to low-to-zero carbon titanium metal powder with a strategic goal of true zero carbon titanium metal production by 2030.
- The development of a fully integrated domestic titanium metal supply chain is of critical strategic importance for the U.S. as the country is the largest global consumer of titanium metal for aerospace and defense but is 100% import reliant on high cost and carbon intensive titanium sponge.
- Titanium metal and powders offer an opportunity to capture additional share of the value chain, from rutile (titanium mineral) prices of ~US$1,200/t to titanium sponge (raw titanium metal) of ~US$8,500/t[i] and ultimately to titanium spherical powders (3D printing / additives) of ~US$300,000/t[i].
- The Company expects interest from customers in the space, aerospace, defense and EV industries, particularly those who have net zero carbon supply chain targets.
- The Company will engage with U.S. Government agencies, targeting financial and commercial benefits to accelerate development, and notes President Biden's pledge to reduce the U.S.'s reliance on imported critical minerals and technology.
- The Company will establish a scientific and technology advisory board, beginning with founding member Dr. Zak Fang, to draw from academia, industry, and government to advance the development of the breakthrough HAMR technology.

Figure 1: From left to right; Anastasios Arima and Dr. Z Zak Fang, Mr. Arima with lab scale furnace, Dr. Pei Sun, Mr. Arima, Mr. Lamont Leatherman standing atop pilot scale furnace.

Commenting on the agreement, Anastasios Arima, Executive Director of TAO commented:

"This is a pivotal moment for our Company as we begin to address the need for cleaner, lower cost U.S. domestic sources of titanium metal. The breakthrough HAMR technology, coupled with the Company's titanium deposit in Tennessee, has the potential to make TAO the leader in this field. This technology adds another important dimension to our business in addition to solving the critical import dependence of the U.S. titanium material market. We are pursuing a low-to-zero carbon strategy and we are fully committed to working with our suppliers and partners to achieve true 'net zero' by 2030."

"My team welcomes Dr. Fang as the founding member of the Company's scientific and technology advisory board and we look forward to working together in developing this technology that is not only critical to America's current aerospace, defense and transportation / EV sectors but is crucial to helping the U.S. achieve its future ambitions in space development and exploration."

Commenting on the agreement, Dr. Z. Zak Fang said:

"We are excited to be working with Mr. Arima and Tao Commodities in progressing the HAMR technology that was developed at the University of Utah, with Boeing and Arconic as industrial partners and with funding support from ARPA-E of the U.S. Department of Energy. The HAMR technology has significant potential to lower the emissions and cost of producing titanium metal, an area of metal production technology which has not seen material change in over 50 years."

This announcement has been authorised for release by the Executive Director.

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Tao Commodities Limited ("TAO" or "the Company") (ASX: TAO) is pleased to announce that the Company, through its wholly-owned subsidiary, Hyperion Metals & Technologies LLC, has entered into a master service agreement ("Research Agreement") with Blacksand Technology, LLC ("Blacksand") for research and development of titanium powders and titanium alloy powders. The Research Agreement centers around the hydrogen assisted magnesiothermic reduction ("HAMR") technology invented by Dr. Z. Zak Fang and his team at the University of Utah. Dr. Fang is a Professor at the University of Utah and founder of Blacksand.

Blacksand agrees to provide the Company with research and development services under the Research Agreement to investigate the scale up and commercialization of the HAMR technology to produce titanium metals powders. The Research Agreement also provides the Company with an option to enter into an exclusive license agreement with Blacksand relating to the HAMR technology ("License Agreement").

Blacksand's HAMR process for the production of titanium metal powders has the potential to be a breakthrough technology for titanium metal and titanium additive manufacturing and brings the potential for low-to-zero carbon, low-cost product to this high growth, high tech and high value market.

U.S. Titanium Metal & Powder Market

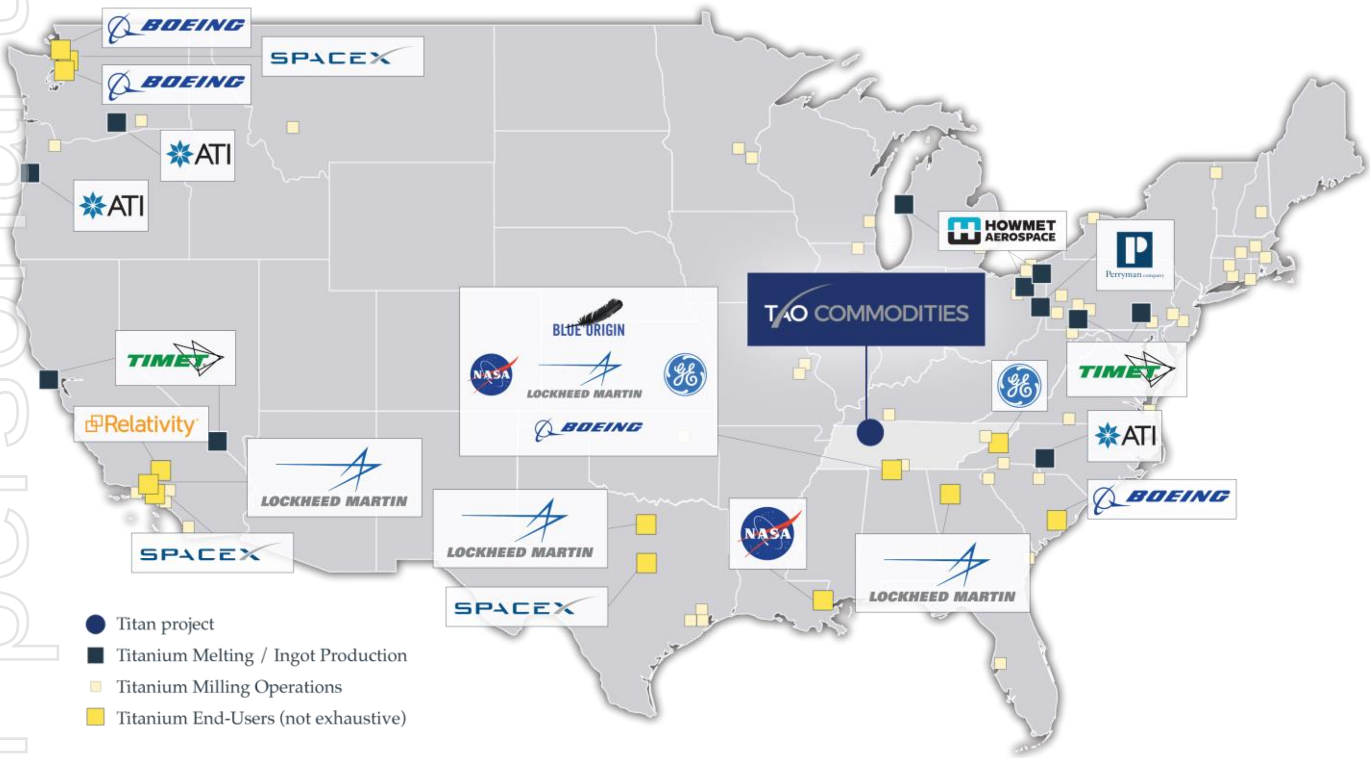

Figure 2: Titanium ingot producers and major U.S. aeronautic and space manufacturing facilities

Titanium is desired by industry for its light weight, high strength to weight ratio, stiffness, fatigue strength and fracture toughness, excellent corrosion resistance, and the retention of mechanical properties at elevated temperatures.

Titanium and titanium alloys are used in diverse areas such as high-performance space, aerospace, defense, automotive components, chemical processing equipment and medical implants. However, a barrier for the widespread use of titanium is the cost associated with manufacturing a finished part, with approximately half of the cost historically associated with fabrication[1]. Additionally, the use of titanium powder to print 3D parts

[1] I Mellor and G Doughty, Novel and Emerging Routes for Titanium Powder Production – An Overview, Key Engineering Materials, Vol. 704, pp 271-281

has been a recent technological breakthrough, allowing the production of parts, including automobiles and aerospace frames and engines, with minimal waste and material loss, resulting in significantly less energy consumption and emissions.

The U.S. market is one of the largest and highest value titanium markets globally due to the significant use of titanium in the high-performance space, aerospace and defense sectors. There is no current titanium sponge production capacity in the U.S. – titanium sponge is the first metal product in the process of converting TiO_2 minerals to titanium metal. The last U.S. domestic titanium sponge plant closed in 2020 in Henderson, NV and as of 2021 the U.S. will be 100% reliant on titanium sponge imports.

Current global titanium sponge capacity is ~328ktpa, centered in China (162ktpa), Japan (65ktpa), Russia (47ktpa), Kazakhstan (26ktpa) and Ukraine (12ktpa).

There is a strategic opportunity for the Company to develop integrated titanium production capacity in the U.S. to provide for this critical supply chain. Additionally, the Company believes that the efficiencies associated with the manufacturing of titanium parts through 3D printing utilizing titanium powder, combined with the energy and emissions savings associated with the production of titanium powder by utilizing the HAMR process, allow the potential to commercialize a highly sought-after low cost, low-to-zero carbon titanium powder production process.

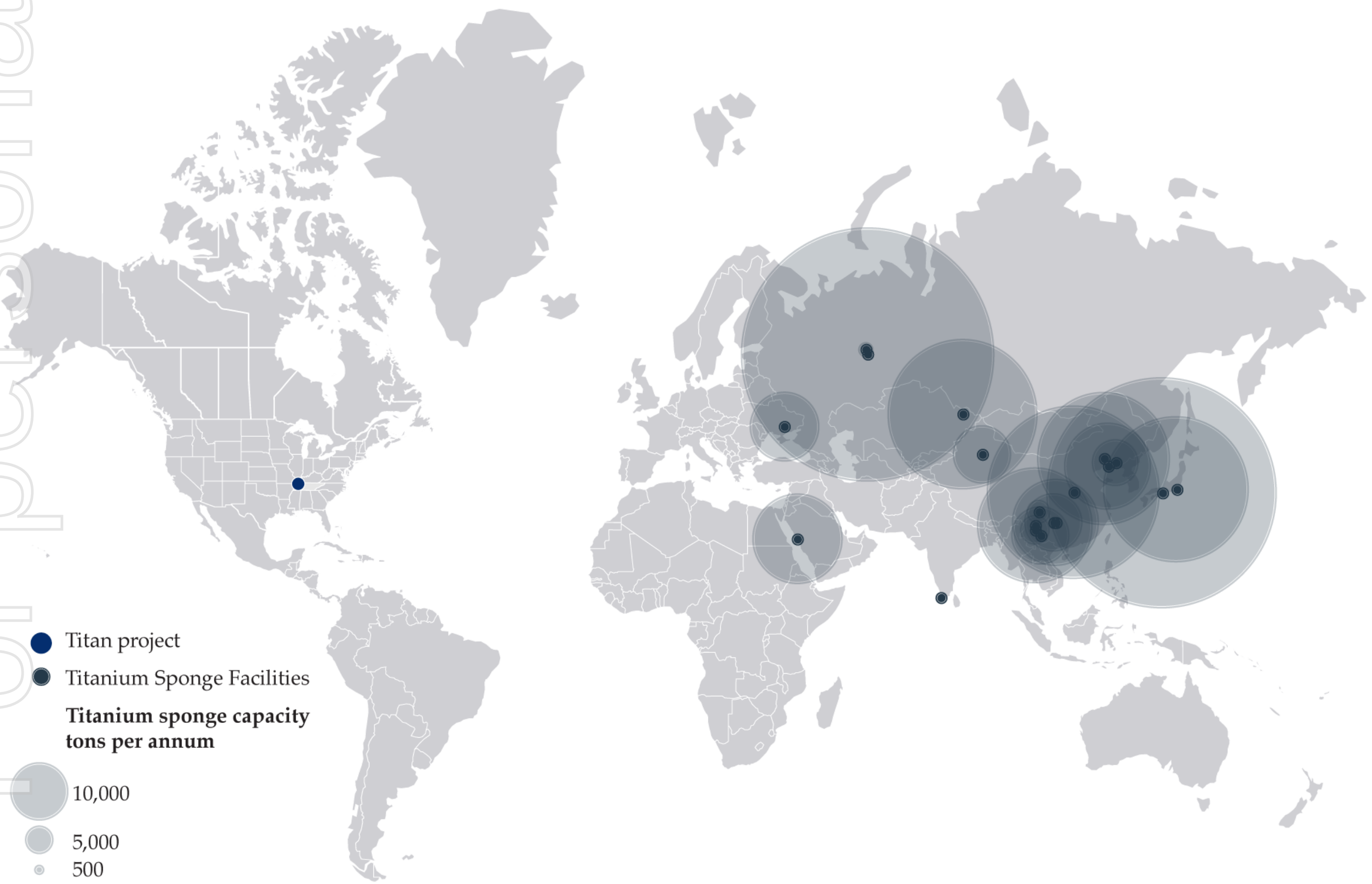

Figure 3: U.S. Titanium sponge production capacity 2021(Roskill)

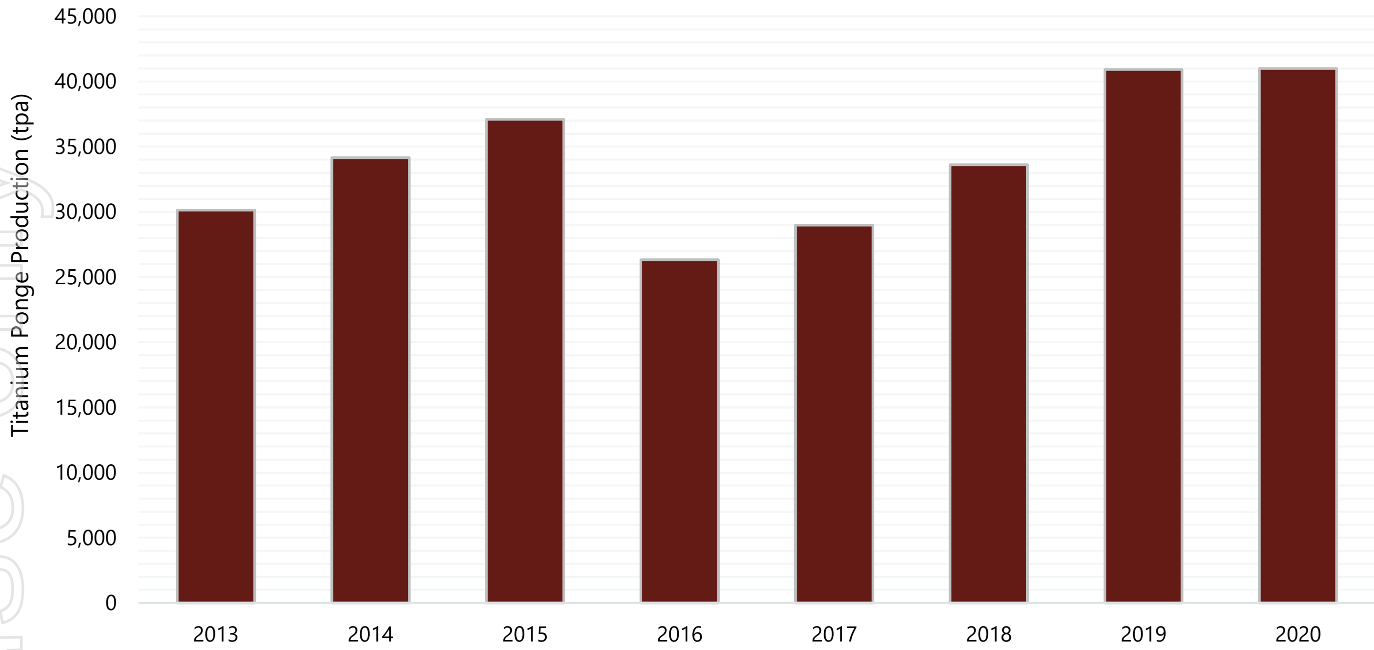

***Figure 4**: U.S. titanium sponge consumption (Roskill)*

Pursuing Zero-Carbon Titanium

The Company's mission in developing the Titan Project and titanium metal powders is to bring the highest levels of sustainability and decarbonization to all aspects of the titanium supply chain.

The HAMR process has the potential to simplify the metal manufacturing process through elimination of process stages, reduction in energy consumption, and elimination of manufacturing inputs. Combined with a commitment to reduce emissions in mining and mineral processing, the Company believes the opportunity exists to create the lowest carbon titanium metal powder production business globally.

TAO plans to develop 'net-zero' titanium metal powder by eliminating on-site carbon emissions and relying on carbon-free electricity.

The Company intends to appoint a third-party life-cycle analysis advisory firm in Q1 2021 to evaluate manufacturing process and global supply chains and advise on focus areas in order to achieve true zero carbon titanium by 2030.

HAMR technology – A Low Cost, Low-to-Zero Carbon Titanium Powder Production Process

Dr. Z. Zak Fang and his team's goal in developing the HAMR technology was to reduce energy intensity and resulting carbon emissions and cost of producing titanium metals, which was the mission of ARPA-E's Modern Electro/Thermochemical Advances in Light Metal Systems ("METALS") program. A technical challenge in titanium metal production is the difficulty in removing oxygen from titanium ores and the subsequent propensity of purified titanium metal to rapidly pick-up oxygen and other impurities.

The current standard technology, the Kroll process, addresses these challenges via converting titanium ore (an oxide) into titanium tetrachloride ($TiCl_4$), and then reducing the chloride to titanium metal with magnesium. Unfortunately, this technology is both capital, energy, and carbon intensive.

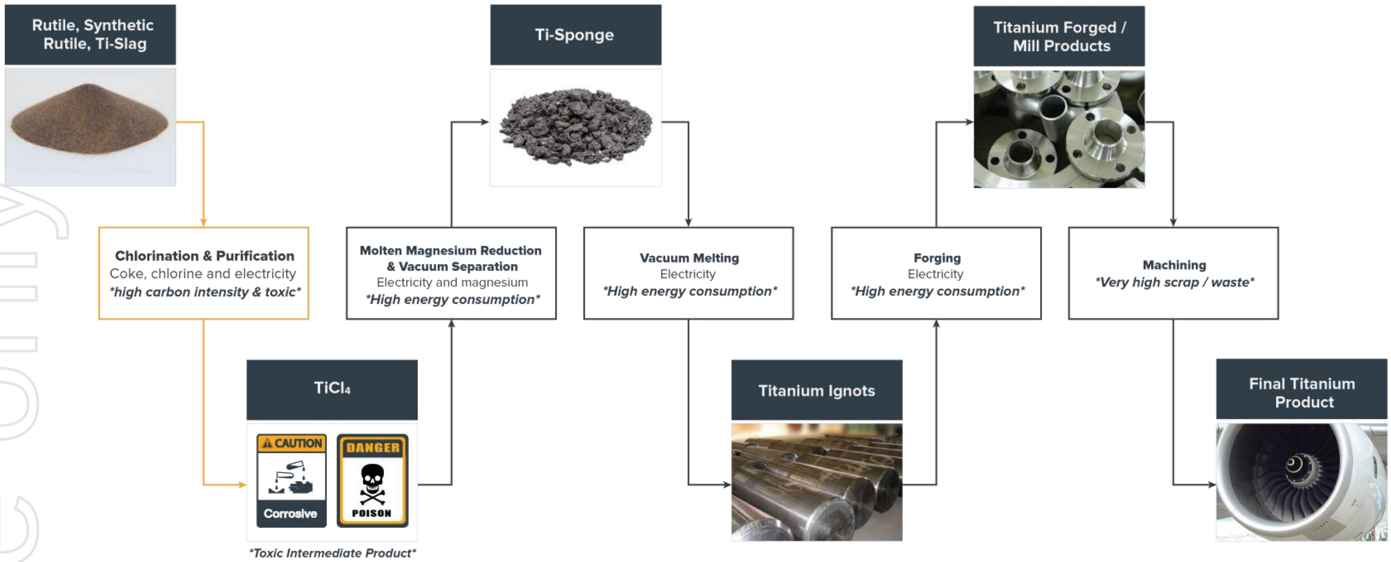

Figure 5: Kroll process diagram

The breakthrough HAMR technology is focused on a novel thermochemical process to extract titanium metal from ore that reduces the cost, energy consumption, and carbon intensity (and other emissions) of producing titanium metal, and results in a titanium metal powder that can be utilized or further processed directly for use in additive / 3D manufacturing processes compared to the Kroll process.

The HAMR technology utilizes hydrogen to destabilize Ti-O, making it possible to turn the reduction of TiO_2 with magnesium from thermodynamically impossible to thermodynamically favored. This allows TiO_2 to be reduced and deoxygenated directly by magnesium to form TiH_2, with low oxygen levels that can meet the needs of the industry. TiH_2 can be further processed to titanium metal through standard industry methods.

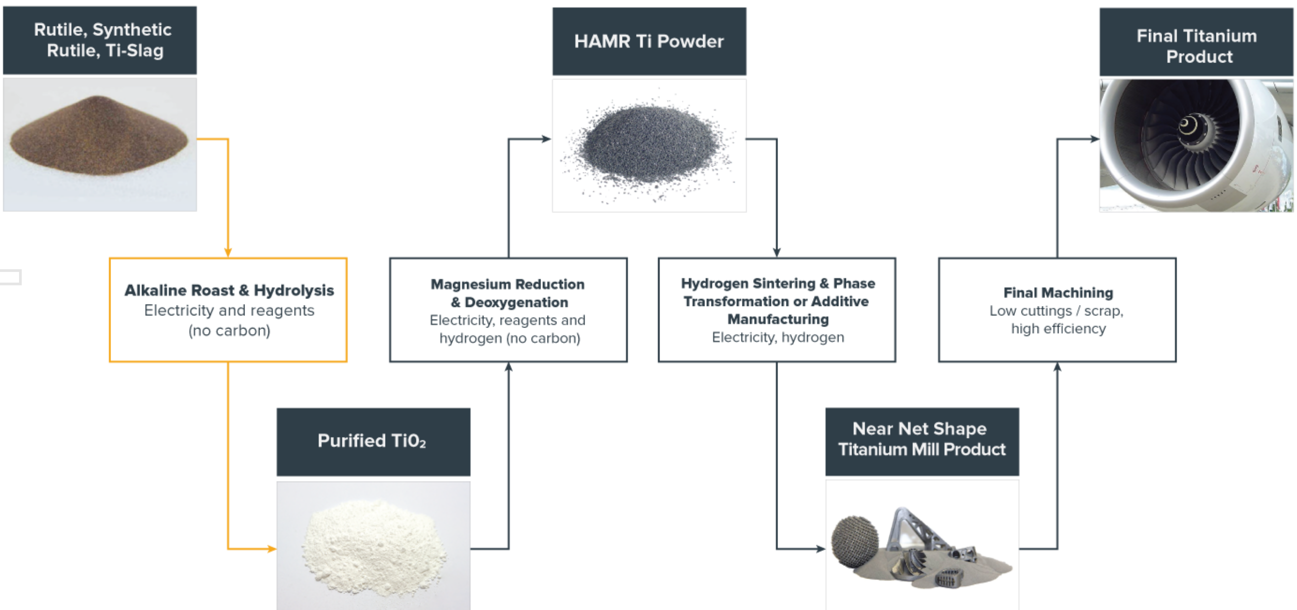

Figure 6: HAMR process diagram

From 2014 – 2019 Dr. Fang and his team worked in collaboration with Boeing and Arconic to develop the technology to a pilot scale at the University of Utah, utilizing ~US$7.0 million in grant funding from ARPA-E and the Advanced Manufacturing Office ("AMO") and Office of Energy Efficiency & Renewable Energy ("EERE") of the U.S. Department of Energy. During this time the university moved the production of titanium powders from a lab scale where less than a kilogram of powders could be produced at one time to a pilot scale where 20 – 40 kg batches could be produced in a 24-hour period.

Titanium powder produced at the pilot scale production utilizing the HAMR technology consistently and reliably meets the purity requirements defined by the industry standard. The result was the successful production and testing of the purity of the powder against the industry standard for general purpose titanium sponge (ASTM B299-13).

Weight %	Mg	Al	Fe	Si	Cl	O	N	C	H
Final HAMR Ti powder	**<0.1**	**<0.03**	**<0.10**	**<0.04**	**<0.1**	**<0.12**	**<0.02**	**<0.03**	**<0.03**
ASTM standard for Ti sponge[2]	0.5	0.05	0.15	0.04	0.2	0.15	0.02	0.03	0.03

Figure 7: HAMR product quality comparison to industry standard product

Further information on the research can be found on the University of Utah's website (https://powder.metallurgy.utah.edu/research/hamr.php) and on ARPA-E's website (https://arpa-e.energy.gov/impact-sheet/university-utah-metals).

A detailed energy-economic analysis and a full process simulation were performed to estimate the energy consumption, emissions, and cost at mass production. The modeling effort included the feed materials, reaction conditions (temperature and pressure), and pretreatment of the feed materials and post-treatment of the products. The result indicated that the HAMR process is >50% less energy intensive and generates >30% less emissions than the Kroll process, even after accounting for an additional purification step of the TiO_2 feed prior to the HAMR process.

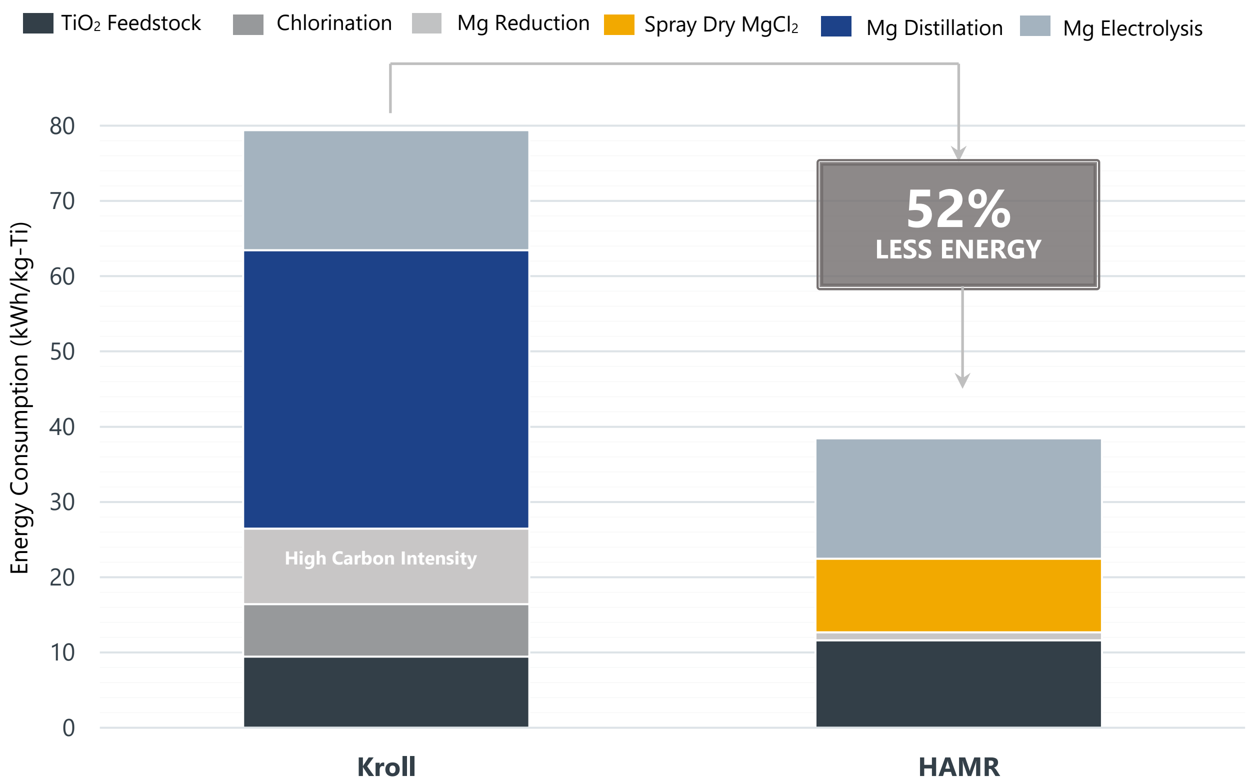

Figure 8: Energy savings analysis for the HAMR v. Kroll process

[2] ASTM-B299-13 (GP Ti sponge)

The majority of the energy and emissions savings come through eliminating the need to chlorinate TiO_2 to make $TiCl_4$, and vacuum distillation after the reduction of $TiCl_4$. This work is also prior to incorporation of any renewable energy utilization in the mining and purification step in processing of the TiO_2 feedstock; hence there is potential for further reduction in the total carbon intensity within the supply chain for HAMR titanium metal production.

Figure 9: From top left, Blacksand and TAO team in product analytical lab at the University of Utah, TiO2 powder to Ti powder, Pilot scale furnace in University of Utah, team at Blacksand Laboratory

Dr. Z. Zak Fang – Biography

Dr. Zhigang Zak Fang is a pre-eminent and globally respected professor of metallurgy, joining the faculty of metallurgical engineering at the University of Utah in 2002. Prior to that, Dr. Fang had a successful industrial R&D career and held various technical and management positions in a number of industrial corporations. He last served as the Director for Materials R&D for Smith Tool of Smith International, Inc.

With such rich industrial experience, Dr. Fang has developed expertise in a wide range of materials including hard metals, refractory metals, polycrystalline diamond, powder metallurgy, fracture-mechanical behavior of brittle materials, metal matrix composites, wear resistant materials, coatings, and other advanced materials processing technologies.

Dr. Fang graduated from the University of Science and Technology Beijing with BS and MS degrees in 1984 and received his Ph.D. degree in materials science and engineering in 1990 from the University of Alabama at Birmingham. Dr. Fang has authored/co-authored approximately 200 peer reviewed technical publications and over 50 U.S. patents. Dr. Fang's achievements include but are not limited to:

- Fellow, National Academy of Inventors;
- Fellow, American Society of Metals (ASM) International;
- Fellow, American Powder Metallurgy Institute (APMI) International;
- Editor-in-Chief, Int. J. Refractory Metals and Hard Materials, Elsevier; and
- R&D 100 Award 2009.

Dr. Fang's work in titanium, titanium alloys, titanium hydride, and titanium dioxide have seen him not only make breakthrough technologies as in the HAMR technology but he has also invented;

- An innovative process for making spherical Ti alloy powder for 3D printing; and
- An innovative hydrogen sintering process for manufacturing high-performance low-cost titanium and titanium alloys.

Further information for Dr. Fang can be found at the University of Utah's website: (https://faculty.utah.edu/u0320607-ZHIGANG_ZAK_FANG/hm/index.hml)

Dr. Fang is the founder and Chief Technology Officer of the University of Utah's spin-off start-up organization, Blacksand Technologies, LLC which will be partnering with the Company to further the development and commercialize the HAMR technology.

Research & Commercialisation Milestones

The aim over the coming development program is to optimize the titanium metal powder production for the Company's titanium minerals found at the Titan Project, and to begin supplying product to customers to begin a supplier qualification process.

Milestone	Indicative Timing
Phase 1.1: Evaluate Alkaline Roasting and Hydrolysis ("ARH") process to convert TAO's Titan Project ore to TiO_2	Q1 2021 – Q2 2021
Phase 1.2: Production of 1 – 5 kg of pure Ti from TiO_2 using the HAMR process. *Intended to be used to be used by TAO for initial customer outreach*	Q2 2021 – Q3 2021
Phase 2: Production of 10 – 20 kg of pure Ti from TiO_2 using the HAMR process. *Intended to be used by TAO for supplier qualification*	Q4 2021 – Q1 2022
Phase 3: Production of 50 – 100 kg of pure Ti from TiO_2 using the HAMR process. *Intended to be used by TAO for supplier qualification*	Q2 2022 – Q4 2022

Scientific & Technology Advisory Board

The Company will set up a Scientific and Technology advisory board to bring together experts in the various fields of titanium metal production, titanium metal powders, industry end-users, environmental sustainability and government, beginning with founding member Dr. Zak Fang. This will allow the Company to gain input from the whole supply chain, from mining of ore through to end-use of titanium metal and powders, and developing sustainable and zero carbon supply chain interaction with the U.S. Government.

The Company will seek to add members to its Scientific and Technology advisory board as it progresses the development and production of titanium metal powders over the coming months.

About Tao Commodities

Tao Commodities Limited ("TAO") holds a 100% interest in the Titan Project ("the Project"), covering ~3,850 acres of titanium and zircon prospective heavy mineral sands ("HMS") properties in Tennessee, U.S. The Project is located in an area which saw significant historic exploration from 1960 – 1990 by DuPont, BHP and others, and included over 200 drill holes and a bulk sample mining operation.

The Project is strategically located in the southeast of the U.S., close to significant manufacturing capacity, providing a significant logistical advantage over current U.S. suppliers of imported titanium feedstock. Specifically, the Project is ~15 km from Chemours' New Johnsonville pigment plant, one of the largest pigment plants globally and within a low-cost barge, truck or rail-served distance to all other major U.S. titanium pigment and metal plants.

The U.S. is the second-largest global importer of titanium feedstocks where it is primarily used to produce TiO_2 pigment for the coatings and plastics sector and Ti metal for the defense, aerospace, space and medical sector. Over the last decade the U.S. has seen a significant decrease in production of both titanium feedstocks and zircon with the closure of Iluka's operations in Virginia in 2016. As a result, import reliance has risen to 95% in 2019, with import values of ~A$1,200 million.

The Company also holds a 100% interest in the Milford Project in Utah, United States, which is considered prospective for base and precious metals.

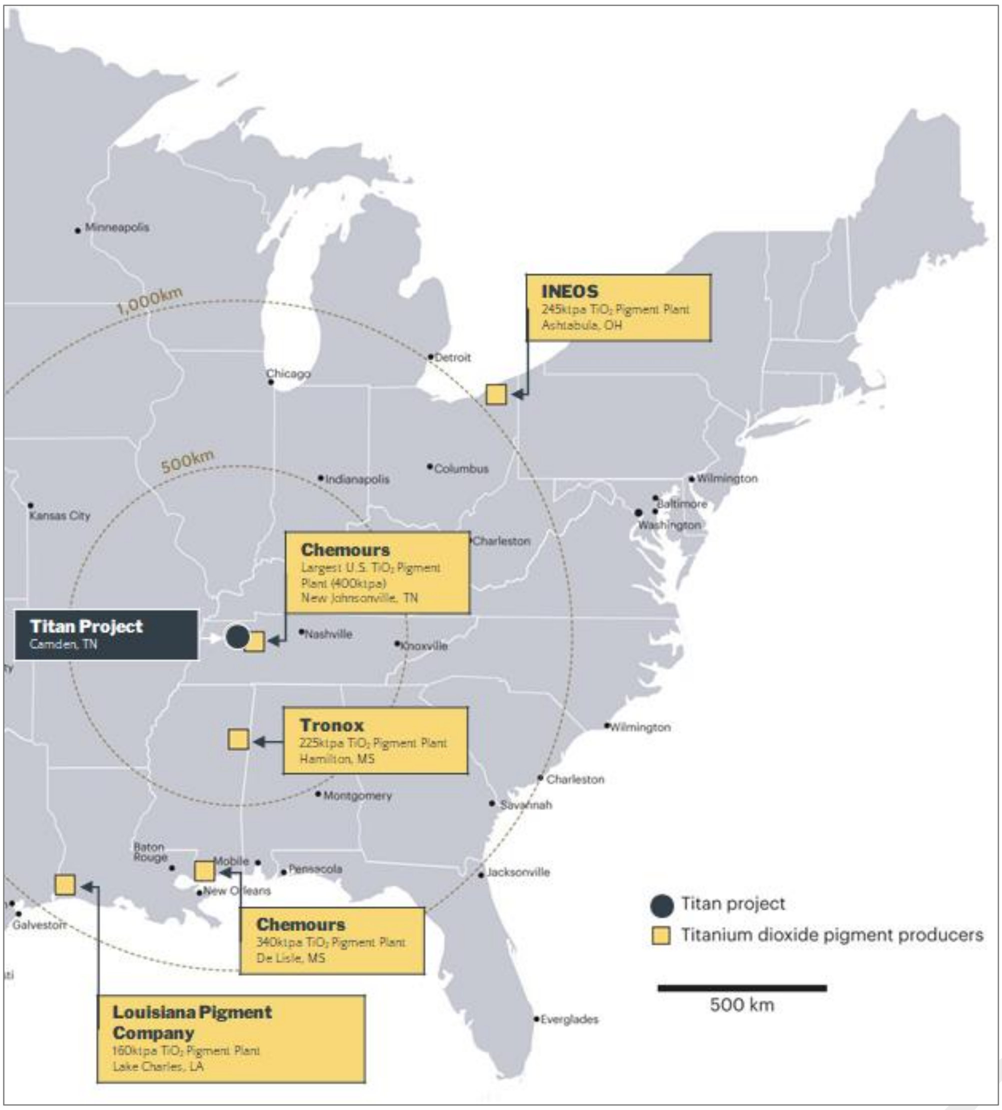

Figure 10: Titan Project location and proximity to major titanium dioxide pigment producers

Appendix I: Key Terms of Research Agreement and License Agreement

- The Company has entered into the Research Agreement with Blacksand to provide research and development ("R&D") services to investigate the scale up and commercialization of the HAMR technology, utilizing titanium feedstocks sourced by the Company.

- The Research Agreement comprises a master services agreement and a scope of work which outlines the terms of the research services to be provided by Blacksand, as summarized above under 'Research & Commercialisation Milestones'. The total cost of the R&D services to be provided is US$480,000 ("R&D Payment Amount") over the term of the Research Agreement.

- The term of the Research Agreement ends on the earlier of the master services agreement being terminated or the completion of the R&D Program. The Research Agreement may be terminated by the Company for any or no reason upon 90 days' prior written notice to Blacksand.

- The Research Agreement provides the Company with an option to enter into an exclusive license agreement with Blacksand over a suite of patents comprising the HAMR technology and related products to be used for the processing of titanium ore or feedstock and the production of titanium metal or alloy.

- The option is exercisable by the Company provided it has paid to Blacksand of the balance of the R&D Payment Amount which has not already been paid to Blacksand under the Research Agreement.

- Upon exercise of the option, the Company will pay total license fees to Blacksand of US$1.9 million over a two-year period. From the third anniversary of the option exercise the Company will pay Blacksand the greater of the minimum annual license payment (between US$150,000 and US$250,000) and a royalty of 3% of the net value of licensed product sold.

- The term of the exclusive license continues as long as the Company continues to pay all amounts due to Blacksand under the License Agreement. The License Agreement may be terminated by Blacksand if the Company breaches the License Agreement. The Company may terminate the License Agreement it the licensed patents are ruled to be not patentable by relevant authorities or by the Company providing 90 days written notice to Blacksand.

Forward Looking Statements

Information included in this release constitutes forward-looking statements. Often, but not always, forward looking statements can generally be identified by the use of forward-looking words such as "may", "will", "expect", "intend", "plan", "estimate", "anticipate", "continue", and "guidance", or other similar words and may include, without limitation, statements regarding plans, strategies and objectives of management, anticipated production or construction commencement dates and expected costs or production outputs.

Forward looking statements inherently involve known and unknown risks, uncertainties and other factors that may cause the Company's actual results, performance, and achievements to differ materially from any future results, performance, or achievements. Relevant factors may include, but are not limited to, changes in commodity prices, foreign exchange fluctuations and general economic conditions, increased costs and demand for production inputs, the speculative nature of exploration and project development, including the risks of obtaining necessary licenses and permits and diminishing quantities or grades of reserves, political and social risks, changes to the regulatory framework within which the company operates or may in the future operate, environmental conditions including extreme weather conditions, recruitment and retention of personnel, industrial relations issues and litigation.

Forward looking statements are based on the Company and its management's good faith assumptions relating to the financial, market, regulatory and other relevant environments that will exist and affect the Company's business and operations in the future. The Company does not give any assurance that the assumptions on which forward looking statements are based will prove to be correct, or that the Company's business or operations will not be affected in any material manner by these or other factors not foreseen or foreseeable by the Company or management or beyond the Company's control.

Although the Company attempts and has attempted to identify factors that would cause actual actions, events or results to differ materially from those disclosed in forward looking statements, there may be other factors that could cause actual results, performance, achievements, or events not to be as anticipated, estimated or intended, and many events are beyond the reasonable control of the Company. Accordingly, readers are cautioned not to place undue reliance on forward looking statements. Forward looking statements in these materials speak only at the date of issue. Subject to any continuing obligations under applicable law or any relevant stock exchange listing rules, in providing this information the company does not undertake any obligation to publicly update or revise any of the forward-looking statements or to advise of any change in events, conditions or circumstances on which any such statement is based.

Competent Persons Statement

The information in this announcement that relates to Exploration Results is extracted from the Company's ASX Announcements dated 7 January 2021 and 3 November 2020 ("Original ASX Announcements") which are available to view at the Company's website at www.taocommodities.com.au.

The Company confirms that a) it is not aware of any new information or data that materially affects the information included in the Original ASX Announcements; b) all material assumptions included in the Original ASX Announcements continue to apply and have not materially changed; and c) the form and context in which the relevant Competent Persons' findings are presented in this report have not been materially changed from the Original ASX Announcements.

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i Roskill - Titanium Metal Outlook to 2030