

# ASX Release

Release Date: 21 January 2021

## Quarterly Activities Report to December 31, 2020

### HIGHLIGHTS

#### ASM Metals Business

- Completed acquisition of 95% interest in joint venture partner Ziron Technology Corporation (Ziron Tech)
- Produced 8.6kg of high-purity zirconium metal powder at 98% Zr and 1.5% Hf
- Korean Atomic Energy Research Institute (KAERI) confirmed de-hafniated zirconium metal meets Korean market requirements
- Agreement with Dongkuk Refractories & Steel to design, develop, assemble, install and verify a 250kg/day commercial plant
- Produced 120kg of titanium copper alloy (99.5% purity)
- Confirmed commercial scalability of the innovative metallisation process
- Confirmed significant environmental benefits of innovative metal process
- Produced 200kg of ferro-neodymium (FeNd - Nd 80%, Fe 20%), a key constituent of strip cast permanent magnet alloys
- Produced 6kg of a neodymium iron boron (NdFeB) magnet alloy at the Korean Institute of Rare Metals (KIRAM) facility



Figure 1 - ASM's Chairman Ian Gandel and Managing Director David Woodall with the successful Ziron Tech team that delivered commercial metal production

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### **Dubbo Project Optimisation**

- Optimisation Feasibility Study (OFS) on track for completion at the end of Q1 2021
- Confirmed the simplification of the Zr circuit, with negligible impact on de-hafniated zirconium circuit
- Independent review of rare earth processing circuit confirmed the validity of the Dubbo Project flow sheet and also identified opportunities for optimisation
- Optimisation of the flow sheet informed finalisation of the OFS scope, with Hatch proceeding on this basis
- Mining consultants engaged for OFS mining costs update
- Utilities, reagents, and consumables quantities have been confirmed, with potential providers invited to quote on supply, capital costs, and delivery
- Requests for quotations for the supply of the processing plant have been sent to key suppliers, with updated pricing information expected by the end of February 2021.
- Logistics analysis is well advanced with no major issues identified in delivery and export.

### **Corporate**

- Cash position totaled A\$ 12.4 M
- Executed and progressed non-disclosure agreements with large Korean EPC companies during the quarter
- Executed agreement with Dongkuk Refractories & Steel to complete the design, development, and construction of a commercial metal plant. Detailed engineering is expected in Q2 2021.
- Progressed discussions with potential strategic partners
- Continued discussions about metal offtake agreements with potential Korean manufactures
- Continued discussions with key Korean Government departments Korean Institute of Technology, Korean Institute of Rare Metals, Ministry of Trade and Industry.

## **DUBBO PROJECT OPTIMISATION**

During the quarter ASM and Hatch Engineering progressed the Dubbo Project Optimisation Feasibility Study (OFS), which remains on target and budget for delivery at the end of Q1 2021. Work has confirmed the simplification of the zirconia circuit. Encouragingly, this simplification will have a negligible impact on the de-hafniated zirconia circuit, and associated recovery of de-hafniated zirconia and hafnium oxide.

An independent review of the rare earth circuit was carried out. The review didn't identify any issues with the flow sheet, and also identified opportunities for optimisation.

The completion of these reviews has resulted in an optimised flow sheet, informing the scope for the OFS to be finalised, with Hatch now proceeding on this basis.

Mining consultants have been engaged to complete an update of the mining costs. Updated requirements for utilities, reagents, and consumables have been confirmed, with potential providers invited to quote on agreements for supply, capital costs, and delivery.

Key to the operating cost estimates is the completion of logistics analysis of the project reagents and consumables. This is well advanced with no major issues identified in delivery and export.

Dubbo Project implementation activities also continued during the quarter. ASM has commenced the development of the project execution philosophy and contracting strategy, including drafts of the project charter, governance, and execution guidelines. Project budget and schedule confirmation continues in parallel with the OFS program and will be finalised as part of the OFS deliverables in Q1 2021.

## ASM METALS BUSINESS

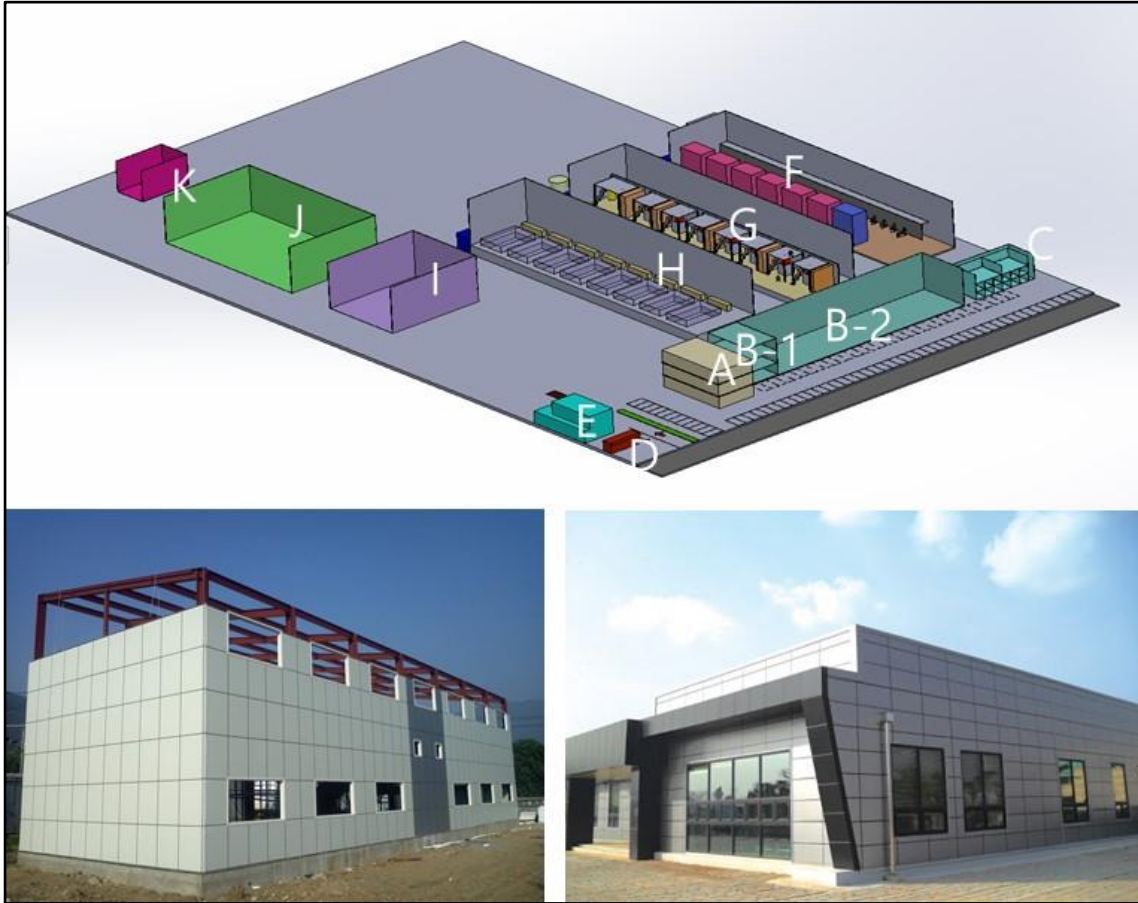
ASM's development of a "mine to manufacturer" metals business continued successfully during the quarter. The company completed the acquisition of a 95% interest in joint venture partner Ziron Technology Corporation (Ziron Tech) (ASX Announcement 3 November 2020). ASM now owns Ziron Tech's patented low-energy, high-purity metal-refining process and the pilot plant in Korea, with the Ziron Tech team integrated into ASM. ASM also completed the updating of patents related to the continual improvement of the metallisation process.

The final production of permanent magnets during the December quarter was impacted by the recent spike in Covid19 cases in the greater Seoul area. This work will now be completed in January 2021 to provide samples of the quality of magnet that ASM's metal business can provide to the Korean domestic market.

Significant advancement in the metals produced during the December quarter included:

- 7.5kg of high-purity dysprosium metal (99.5% purity), confirming the metallisation of all key rare earth magnet metals produced by the Dubbo Project (ASX Announcement 1 October 2020)
- 8.6kg of high-purity zirconium metal powder at 98% Zr and 1.5% Hf (ASX Announcement 15 October 2020)
- A laboratory sample of de-hafniated zirconium metal was confirmed by the Korean Atomic Energy Research Institute (KAERI) to meet the requirements of the Korean market (ASX Announcement 15 October 2020).
- 120kg of titanium copper alloy (99.5% purity) to confirm the commercial scalability of ASM's proprietary metallisation process (ASX Announcement 19 November 2020)
- 200kg of ferro-neodymium (FeNd - Nd 80%, Fe 20%), a key constituent of strip cast permanent magnet alloys (ASX Announcement 11 November 2020)
- 6kg of a neodymium iron boron (NdFeB) alloy was produced at the Korean Institute of Rare Metals (KIRAM) facility; KIRAM certified the NdFeB alloy, derived from ASM's FeNd alloy, is suitable for rare earth permanent magnet production (ASX Announcement 1 December 2020)

During the quarter ASM also signed an agreement with Dongkuk Refractories & Steel to design, develop, assemble, install and verify a 250kg/day commercial metallisation plant (ASX Announcement 2 November 2020).



*Figure 2- Concept Design of Korean Metal Plant*

Based on the successful work completed by the team at Ziron Tech, ASM will have a scoping study of a Korean Plant completed in Q1 2021.

With the confirmation of the commercial scalability of ASM's innovative metallisation process, along with its significant environmental benefits, ASM will now progress detailed engineering of a 5,200t per year metals plant that will initially produce:

- Titanium metal
- Nickel-titanium alloy
- Copper titanium alloy
- Titanium powders
- Neodymium metal
- Dysprosium metal; and
- NdFeB strip metal alloy for permanent magnet production.

With the successful construction and commissioning of the metal plant, ASM will then look to expand the facility increasing the capacity of the plant, that then would produce zirconium metal and other metal products.

ASM is in discussion with several provincial cities in South Korea which have expressed interest in having the first metallisation plant located within their well-served industrial districts. ASM will provide a further update in Q1 2021.

## CORPORATE

### Cash

Cash position totaled 12.4 \$M. The below waterfall chart highlights the quarterly movement in cash held.

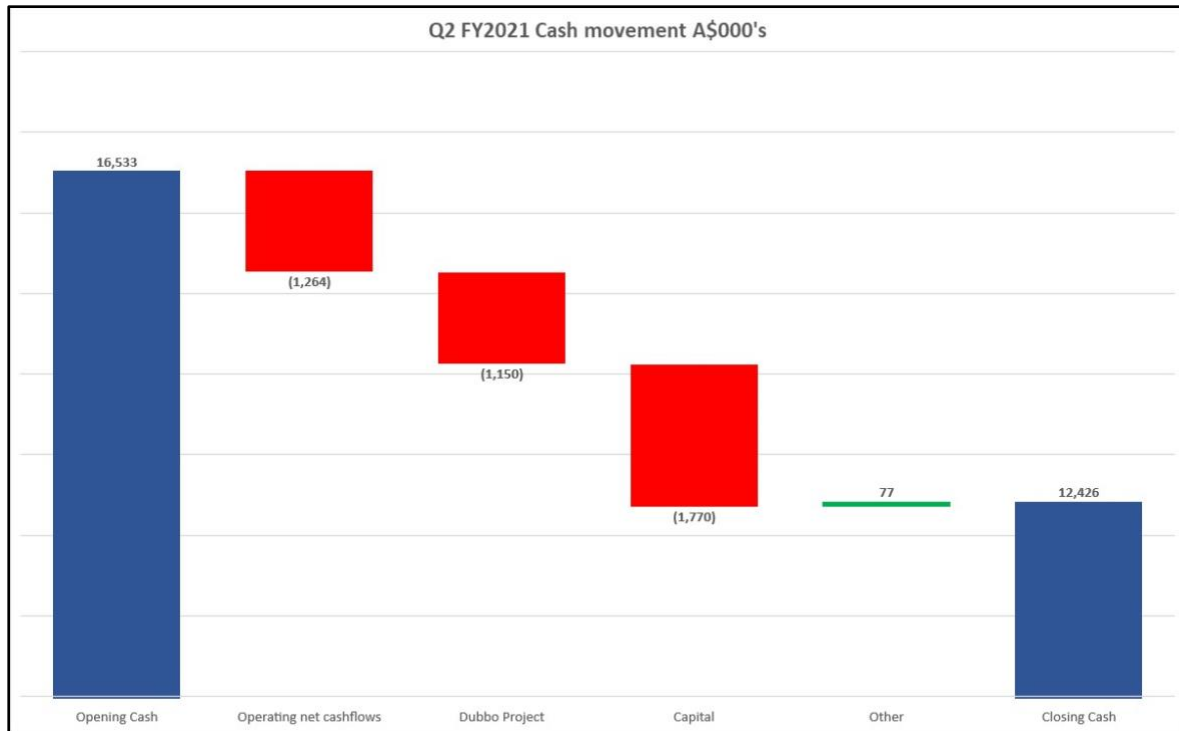


Figure 3 - December Quarterly Cash Movement

## PRODUCT MARKETING

With 2020 overshadowed by Covid-19 and associated disruptions to business and critical materials supply chains, there are now positive signs that a sustained recovery is underway. This is supported by government stimulus programs, with a focus on more aggressive decarbonisation targets that require a more rapid uptake of electric vehicles, plus greater use of renewable energy, especially offshore wind power. Both segments will increase growth rates and demand for rare earth permanent magnets (REPM).

China continues to dominate the rare earth permanent magnet (REPM) market from raw materials to finished products, but now also seeks to import rare earth concentrates. This has highlighted the need for new independent magnet supply chains. ASM is well placed to participate through its metallisation activities in South Korea and its Dubbo Project.

The table below shows indicative prices for ASM's rare earth metals used in permanent magnets (neodymium, praseodymium, dysprosium, terbium), plus other key Dubbo Project elements (which include zirconium, hafnium, and niobium), as well as titanium alloy used in aerospace. Prices for downstream value-added metals and alloy prices are provided since most Dubbo Project elements are ultimately consumed as metals or alloys.

Material <sup>1</sup>		Dec 2019	Mar 2020	Jun 2020	Sep 2020	Dec 2020
Rare Earth Permanent Magnets	US\$/kg	\$45.6	\$48.9	\$45.7	\$46.0	\$47.4 (Nov)
Neodymium-Praseodymium Metal (min 99%)	US\$/kg	\$51.3	\$49.8	\$50.6	\$61.6	\$78.6



Dysprosium Metal (min 99%)	US\$/kg	\$297.5	\$375.0	\$342.0	\$337.0	\$375.7
Terbium Metal (min 99.9%)	US\$/kg	\$644.5	\$769.0	\$787.0	\$920.0	\$1,311.3
Zirconium Sponge (min 99.4% Zr)	US\$/kg	\$34.2	\$34.2	\$24.5	\$20.8	\$20.8
Fused Zirconia (98.5% ZrO <sub>2</sub> )	US\$/t	\$3,830	\$3,790	\$3,750	\$3,680	\$3,472
Zirconium Oxychloride (36.0% ZrO <sub>2</sub> )	US\$/t	\$2,130	\$2,130	\$2,060	\$1,950	\$1,820
Hafnium Metal (<1% Zr)	US\$/kg	\$775.0	\$785.0	\$775.0	\$775.0	\$750.0
Ferro Niobium (65% Nb) <sup>2</sup>	US\$/kg	\$39.0	\$37.3	\$35.0	\$34.8	\$39.5
Titanium Ingot (Ti 6Al 4V) <sup>3</sup>	US\$/kg	\$22.7	\$22.7	\$17.4	\$18.2	\$18.1

Table 1 - Critical Metals Pricing - Q4 2020

Sources: Argus Metals and Asian Metal. 1. All prices are FOB China unless otherwise noted, 2. Du Rotterdam, Netherlands, 3. FOB United States, 4. US\$1.00=Yuan 6.73

Prices for key magnet rare earths surged during the December 2020 quarter as magnet producers restocked in response to stronger demand which had depleted their stocks. Further demand is coming from China's State Reserve Bureau, which is also understood to be stockpiling material. Increased rare earths prices are expected to flow through to magnet prices as producers pass on cost increases.

China's export prices for neodymium-praseodymium (NdPr) metal increased by 28% during the December quarter, and have now increased by almost 60% since their mid-year low of around US\$50/kg. Prices for neodymium metal increased even further to around US\$94/kg during December, which is 78% higher than mid-year. Neodymium metal is currently selling at a 20% premium over NdPr metal, reflecting strong demand for high-performance magnets for electric vehicle (EV) traction motors. This also extends to dysprosium and terbium metals, which are typically used for high-performance magnets. Dysprosium metal prices ended the year at around US\$376/kg, up by 26% during 2020, while terbium metal prices have more than doubled during the year to over US\$1,300/kg. Dysprosium and terbium are typically interchangeable in magnets at a ratio of 2:1, but a supply squeeze for terbium has pushed prices higher.

Global electric vehicle sales are predicted by Argus Metals International to increase from 2.1 million in 2020 to 23 million in 2030, with BEV's accounting for 18.8 million and PHEV's 3.3 million.

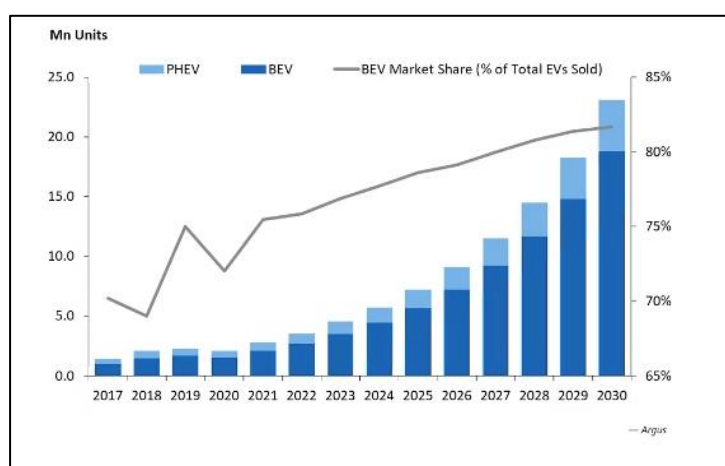


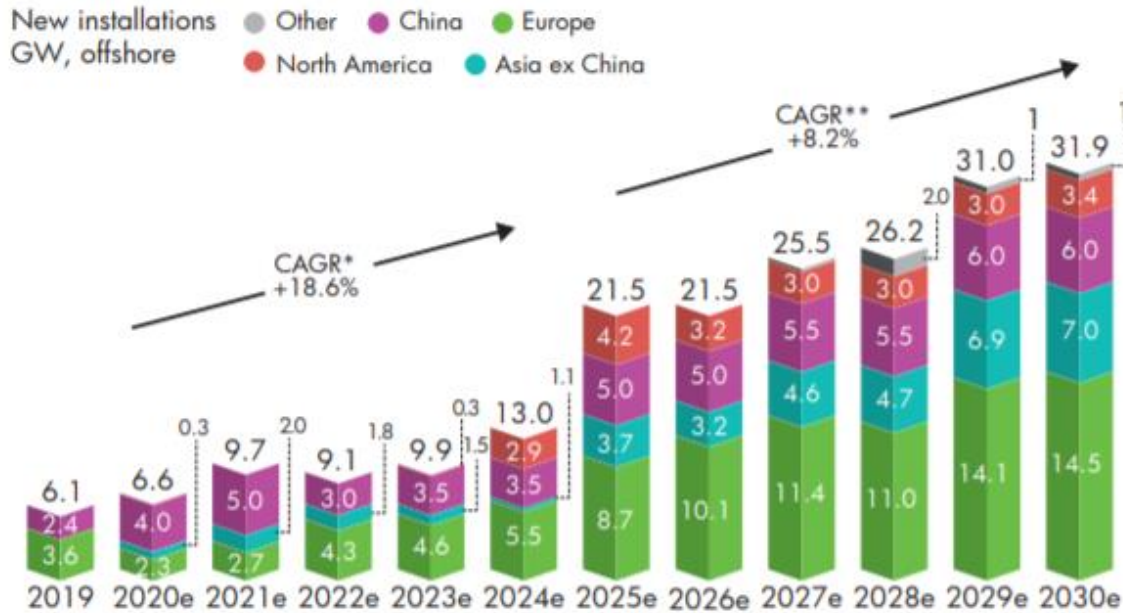
Figure 4- Electric Vehicle Sales - 2017 to 2030

Source: Argus Metals International 2020

Demand growth for EVs is set to accelerate further as national governments bring forward decarbonisation initiatives to phase out internal combustion engines (ICE). The UK government has brought forward the ban on new petrol and diesel cars by 10 years to 2030,

while Japan is targeting 100% electrification by the mid-2030s. With other countries set to follow similar timetables, demand for REPMs in EVs is set to accelerate.

On top of high growth rates for EVs, there is a greater push for renewable energy, particularly offshore wind power. Wind power mostly relies on direct-drive motors using REPMs, with approximately 200kg of NdPr metal used per GW of capacity. The Global Wind Energy Council (GWEC) is forecasting 31.9GW of offshore capacity by 2030, which would require around 40,000 tonnes of neodymium-praseodymium and dysprosium metals during this decade.



\* CAGR = Compound Annual Growth Rate

Figure 5- Global Offshore Wind Growth to 2030 (GW)  
Source: GWEC Market Intelligence, June 2020

Prices for zirconium chemicals and oxides were generally lower during the quarter, due to weak demand as consumers reduced stocks this year. Prices for zirconium metal sponge remained stable. Hafnium metal prices remained relatively stable, despite the downturn in the aerospace industry in 2020.

Ferro-niobium finished the year where it started, following an increase in the December quarter. The major low-cost producer is reportedly sold out for 2021, which is supporting prices, plus the US dollar has depreciated around 13% against the Euro since March this year. A recovery in global steel production should support stable demand for ferro-niobium in 2021 as a result of government stimulus measures for construction investment.

## MINING TENEMENTS

Australian Strategic Materials Limited confirms the following information as of 31 December 2020 (as required by ASX Listing Rule 5.3.3).

Tenements	Mining tenements acquired during the quarter	Mining tenements disposed of during the quarter	Mining tenements held at the end of the quarter	Tenement location
EL 5548			100%	Dubbo NSW
EL 7631			100%	Dubbo NSW
ML 1724			100%	Dubbo NSW

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**This document has been authorised for release to the market by David Woodall, Managing Director.**

About Australian Strategic Materials – [www.asm-au.com](http://www.asm-au.com)

Australian Strategic Materials Ltd (ASM) is an integrated materials business and emerging “mine to manufacturer” producer of [critical metals](#). The company’s cornerstone [Dubbo Project](#) (100% owned) is a proven long-term resource of [rare earths](#), [zirconium](#), [niobium](#) and [hafnium](#) located in central western NSW, Australia. It represents an alternative, sustainable and secure source of these metals, which are critical for a diverse range of advanced and clean technologies.

ASM’s metals business is founded on a novel [metallisation process](#) that converts oxides into high-purity metals, alloys and powders using less energy than conventional methods. The pilot plant in South Korea has proven the commercial scalability of the process and successfully produced a range of high-purity metals and alloys, including titanium, neodymium, praseodymium, dysprosium and zirconium. Following this success, ASM’s first metallisation plant will be constructed in South Korea to supply a range of critical metals including rare earths, zirconium and titanium.

A Dubbo Project optimisation study will be completed by the end of Q1 2021, targeting improved capital and operating costs, along with increased revenue stream. Elements of this optimisation study include simplifying the flowsheet, increasing recoveries of rare earths, and potentially including a front-end flotation circuit.