

6 June 2019



## *Investment in Clean Metal Processing Technology*

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Alkane Resources Ltd (ASX: ALK) (**Alkane**) through its wholly owned subsidiary Australian Strategic Materials Limited (**ASM**) has executed a binding agreement with Zirconium Technology Corporation (a South Korean company) (**Ziron Tech**) to fund the final stage research and feasibility in relation to a clean metal process to convert metal oxide – including key Dubbo Project metals - to metals of high marketable purity (**Technology**).

The agreement incorporates:

- A new, Korean-domiciled company established, with Ziron Tech and ASM as shareholders;
- Ziron Tech to provide an exclusive license to the new company of its intellectual property and expertise in relation to the Technology;
- ASM to invest US\$1.2m towards a pilot plant facility to complete late-stage piloting and feasibility study for larger scale development and commercialisation of the process;
- Alkane subsidiary ASM to have exclusive global rights to use the Technology at commercial scale in relation to zirconium and hafnium under an agreed license and royalty regime.

### **History of Technology – Chungnam University and ASM**

Since 2014, ASM has been working with senior members of Chungnam National University's (**CNU**) Department of Materials Science and Engineering in Daejeon, South Korea. CNU scientists have been developing a patented carbon free process to convert metal oxides into metals through a proprietary electrolysis process (**Technology**). The Technology is viewed as having the potential to replace the Kroll process – a highly energy intensive process that has been used broadly in industry since its development in the 1940s. As well as providing a more environmentally sustainable process, the Technology, when commercialised, is estimated to reduce metallisation costs by in excess of 50%, and produces metals with very low levels of gases, particularly oxygen and nitrogen.

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The Technology also uses Solid Oxide Membranes (SOM) made from yttria stabilised zirconia to replace carbon electrodes, and produces oxygen as a by-product. Commercialisation of SOMs using yttria stabilised (YSZ) for extraction of any of the major industrial metals would create unprecedented demand for both yttrium and zirconium. Currently, China dominates global zirconium and rare earths production with doubtful sustainability.

#### **Electrolysis Process: 50g of Hafnium metal**



#### **Advantages of the Technology and impact on Dubbo Project**

Ziron Tech and its founders have developed and proven at laboratory bench scale a carbon free process to convert metal oxides into metals through an electrolytic process (**Technology**). SOM made from yttria-stabilised zirconia are central to the Technology. This revolutionary carbon free metals process produces oxygen as a by-product and could provide a cost-effective and environmentally superior alternative to the traditional Kroll process used to make high purity zirconium, hafnium, and titanium metals. The Technology is applicable to magnet rare earth metals and other key industrial metals.

This represents an investment in downstream processing for ASM and is entirely consistent with Alkane's strategy of maximising the economic benefits of the entire Dubbo Project value chain for its shareholders.

The Technology is applicable to the majority of ASM's Dubbo Project products, including zirconium, hafnium, and permanent magnet rare earths metals (neodymium, praseodymium, dysprosium and terbium). Together, these elements represent over 80% of the Dubbo Project forecast revenue streams.

The incorporation of this Technology will enable ASM to market high purity rare earth metals, nuclear and industrial grade zirconium metal and high purity hafnium metal to global customers, many of whom ASM is already in active engagement in the marketing of Dubbo Project offtake. Based on existing prices for these products, the inclusion of this Technology will result in integrated economics far superior to the standalone development of ASM's 100%-owned Dubbo Project.



## Signing Ceremony at Chungnam University, Daejeon, South Korea (5 June 2019)



### **Other Specialty Metals**

While the Technology has implications for ASM's Dubbo Project, it also has broader application across significant industries such as titanium, magnesium, and niobium, and ASM has the capacity and legal right to benefit from its involvement in the development of the technology with CNU and the other Ziron Tech shareholders. The following Periodic Table shows the metals which could potentially use this new process.

### Suitability of Ziron Tech Electrolysis Process

H																		He
Li	Be												B	C	N	O	F	Ne
Na	Mg												Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
Cs	Ba	Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
Fr	Ra	Lr	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg								

Suitable and experimentally verified

Suitable but not verified

Theoretically possible

H<sub>2</sub> reduction is better

La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No



### **Confirmatory Work Pre-Commercialisation**

Under the Agreement, ASM will provide US\$1.2m for the purchase of equipment for the construction of a dedicated pilot plant to be located on site at CNU. ASM will also provide rare earth metal oxides, zirconia (i.e. zirconium dioxide) and hafnia (hafnium oxide) for use in the Pilot Plant. ASM will be responsible for the marketing of finished products during the Pilot Plant phase, and has the exclusive global rights to commercialise the Technology under license. In the event that the piloting phase requires more working capital, Alkane has agreed to provide a loan facility of US\$0.6m to the subsidiary at a market based interest rate. This may be converted into a higher equity interest at a later date.

During the Pilot Plant phase, ASM will work closely with Korean and other international consumers of zirconium metal, including major nuclear industry participants. Discussions with electric vehicle and electronics industry participants are ongoing in relation to rare earth offtake. Offtake discussions and strategic partner considerations in relation to investment and other products from the Dubbo Project remain ongoing.

The Pilot Plant is expected to run throughout 2019 and 2020, during which time commercialisation discussions can progress with potential co-investment partners. ASM is expecting to be in a position to take Final Investment Decision in relation to one or more commercial plants in 2020, with relatively short construction periods expected.

### **Structure for Investment**

ASM has entered into a binding agreement with Ziron Tech and its partners to mutually progress the technology through the Pilot Plant through the supply of raw materials, the funding of equipment and the marketing of finished products.

Further, a new company has been established, with ASM holding 10%. A Shareholders Agreement, executed between the parties, sets out Alkane's rights and obligation during the Pilot Plant stage, as well as documenting ASM's rights to commercialise the Technology in relation to zirconium and hafnium through a license agreement.

Alkane's Managing Director, Nic Earner, commented:

*"We have watched with great interest and supported the success of CNU in developing and refining its metallisation technology, aware of the very significant environmental benefits, material cost reductions and high purity metal outcomes. Once piloted and proven, we believe this technology has the opportunity to reshape the metallisation industry for ASM's key product lines, and we welcome the opportunity to build on the strong relationship we have formed with the Ziron Tech team over the last five years. This has the potential to be a breakthrough for ASM in its product marketing and will have obvious positive implications for the Dubbo Project economics."*

### **Update on Dubbo Project**

This investment represents the final significant outlay expected by Alkane's ASM subsidiary prior to project financing for the Dubbo Project being achieved. The Dubbo Project remains construction ready, with material offtake discussions underway.





### Disclaimer

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### ABOUT ALKANE - [www.alkane.com.au](http://www.alkane.com.au) - ASX: ALK and OTCQX: ANLKY

Alkane is a gold production company with a multi-commodity exploration and development portfolio. Alkane's projects are predominantly in the Central West region of NSW, but extend throughout Australia.

Alkane's gold production is from the Tomingley Gold Operations (TGO) which has been operating since early 2014. Alkane has investments in other gold exploration and development companies.

Alkane's most advanced gold exploration projects are in the 100% Alkane owned tenement area between TGO and Peak Hill and have the potential for sourcing additional ore for TGO.

Alkane has other 100% owned exploration tenements in Central Western NSW prospective for gold and copper.

Alkane's largest non-gold project is the Dubbo Project (DP), a large in-ground resource of zirconium, hafnium, niobium, yttrium and rare earth elements. As it is an advanced polymetallic project outside China, it is a potential strategic and independent supply of critical minerals for a range of sustainable technologies and future industries. It has a potential mine life of 75+ years. The DP is development ready, subject to financing, with the mineral deposit and surrounding land acquired and all major State and Federal approvals in place.

