

# The future looks bright for zirconium

## The most important metal you never heard of

*“Zirconium is yet another example of an obscure critical material with great potential in new technology where China controls the supply chain.” – Donald Bubar, President & CEO at Avalon Advanced Materials Inc.*

Zirconium is a relatively obscure but important element that is finding increasing application in a range of new technologies. It is most commonly found in zircon ( $ZrSiO_4$ ), an industrial mineral used directly in many high-temperature applications. Zirconium in its many forms is now an essential part of cell phones, nuclear plants, dialysis machines, paint, ceramics and catalytic converters.

Zirconium was discovered in 1789 but it took 35 years to isolate the element. It took another 100 years before a pure zirconium metal was produced. With a high specific gravity, zircon is commonly found with other heavy minerals in deposits of prehistoric beach sands. It is usually a byproduct of mining these sands for titanium. Heavy mineral sand resources are found in several parts of the world with much of the historical production coming from South Africa and Australia. There is another rarer zirconium ore mineral called baddeleyite ( $ZrO_2$ ) presently only recovered from an iron ore mine in Russia. As with many technology metals, the challenge of zirconium is in the economic processing of the mineral concentrates, not in mining the resource. Much of this processing is currently being done in China.

The ceramic pigment market was the main early driver for the

development and production of zirconium chemicals of various types. After World War II, the ceramic/refractory industry became interested in zircon and zirconium oxide while the Department of Defense focused on the pure metal of zirconium. The driver behind the need to produce a pure zirconium metal on an industrial scale was to supply the military with alloys of magnesium and zirconium. The second major military market development for pure zirconium metal was for cladding fuel rods for both the nuclear navy reactor as well as for civilian nuclear power stations.



There are at least three things that use zirconium in this photo – the ceramic mug, the cellphone and the wall paint.

Today some of the many applications for different zirconium compounds include kidney dialysis, coated paper (frozen food packaging), pigment coating ( $TiO_2$ ), paint driers, and thixotropic paints (paints that are free-flowing and easy to apply while being brushed on, but quickly reset into a gel). As industry has gained a better understanding of the chemistry, it has been able to move into the growing market of advanced ceramic/oxide applications. Some applications of zirconium ceramics are piezo electrics (spark ignitors, sonar devices, and ultrasonics), thermal barrier coatings (turbine blades), solid electrolytes (oxygen sensors, fuel cells), and catalysts (cracking of petroleum, catalytic convertors).

Demand for zirconium and the appeal of producers will continue to grow, and because of its unique physical and chemical properties it will find application in many new growth technologies, including more efficient and environmentally-friendly clean technologies. It won't take long before its critical importance is appreciated.

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# Alkane to demerge Australian Strategic Materials (ASM) to unlock value of its rare earths project

Alkane Resources Ltd. (ASX: ALK | OTCQX: ALKEF) plans to soon demerge their poly-metallic and rare earths holding company Australian Strategic Materials Limited (ASM) and pursue a separate listing of ASM on the Australian Stock Exchange. ASM is the 100% owner of the very promising, long life, poly-metallic and rare earths project known as The Dubbo Project, located in NSW, Australia.

Today I look at what investors need to know and the potential of the new company.

## About Australian Strategic Materials (ASM)

ASM's three key assets include:

- **The Dubbo Project** – ASM owns a 100% interest in the project which is a 'construction ready' poly-metallic and rare earths project with potential to become a key global supplier of specialty metals and rare earths.
- **Metals Technology Business** – ASM is investing in new technologies related to the separation, purification and metallisation of oxides. ASM's goal is to establish an independent facility that produces high-purity metals and value-added metal oxides, particularly in relation to hafnium separation from zirconium and other materials from The Dubbo Project. In 2019 ASM initiated a joint venture with South Korea's Zirconium Technology

Corporation (ZironTech) to pilot the production of hafnium and zirconium by combining their proprietary process with ZironTech's metallisation technology. ASM has exclusive global commercialisation rights under the licence. The pilot plant is in the final stage of construction in South Korea and production is due to commence in mid-2020.

- **Toongi Pastoral Company** – The Company owns 3,500 hectares of freehold and leasehold land 25kms south of Dubbo, NSW, Australia.

## Highlights of ASM's 100% owned Dubbo Project



Source

## The Dubbo Project

The Dubbo Project is a large resource of zirconium, hafnium, niobium, and rare earths (including praseodymium, neodymium, and yttrium). It is the most advanced poly-metallic project of its kind outside China. The Project has an incredible estimated **70 year mine life** and can be an open pit design. The Project is ready for construction with all major state and federal approvals and licences in place.

The 2013 DFS resulted in a pre-tax NPV8% of A\$1.235 billion,

and a pre-tax IRR of 19.3%. The Company has since proposed a two stage production start up so as to lessen the first stage CapEx from an estimated US\$930 million to US\$480 million.

Total Mineral Resources are 75.18Mt @ 1.89% ZrO<sub>2</sub>, 0.04% HfO<sub>2</sub>, 0.44% Nb<sub>2</sub>O<sub>5</sub>, 0.03% Ta<sub>2</sub>O<sub>5</sub>, 0.74% TREO. Total Ore Reserves are 18.90Mt @ 1.85% ZrO<sub>2</sub>, 0.04% HfO<sub>2</sub>, 0.44% Nb<sub>2</sub>O<sub>5</sub>, 0.029% Ta<sub>2</sub>O<sub>5</sub>, 0.735% TREO.

## The Dubbo Project resource estimate

### Dubbo Project – Mineral Resources

Resource Category	Tonnes (Mt)	ZrO <sub>2</sub> (%)	HfO <sub>2</sub> (%)	Nb <sub>2</sub> O <sub>5</sub> (%)	Ta <sub>2</sub> O <sub>5</sub> (%)	Y <sub>2</sub> O <sub>3</sub> (%)	TREO* (%)
Measured	42.81	1.89	0.04	0.45	0.03	0.14	0.74
Inferred	32.37	1.90	0.04	0.44	0.03	0.14	0.74
<b>Total</b>	<b>75.18</b>	<b>1.89</b>	<b>0.04</b>	<b>0.44</b>	<b>0.03</b>	<b>0.14</b>	<b>0.74</b>

\*TREO% is the sum of all rare earth oxides excluding ZrO<sub>2</sub>, HfO<sub>2</sub>, Nb<sub>2</sub>O<sub>5</sub>, Ta<sub>2</sub>O<sub>5</sub>, Y<sub>2</sub>O<sub>3</sub>

### Dubbo Project – Ore Reserves

Reserve Category	Tonnes (Mt)	ZrO <sub>2</sub> (%)	HfO <sub>2</sub> (%)	Nb <sub>2</sub> O <sub>5</sub> (%)	Ta <sub>2</sub> O <sub>5</sub> (%)	Y <sub>2</sub> O <sub>3</sub> (%)	TREO* (%)
Proved	18.90	1.85	0.04	0.440	0.029	0.136	0.735
Probable	0						
<b>Total</b>	<b>18.90</b>	<b>1.85</b>	<b>0.04</b>	<b>0.440</b>	<b>0.029</b>	<b>0.136</b>	<b>0.735</b>

Next steps for ASM will include:

- Proof of capability for commercial-scale production of hafnium and zirconium.
- An updated FS or BFS.
- Forming strategic customer relationships and offtake agreements.
- Establishing the capability to process other Dubbo Project outputs, including rare earth metals, in Australia and South Korea.
- Project financing. Export Finance Australia (EFA) recently confirmed interest in being part of the financing consortium for The Dubbo Project.

## About the demerger

- The demerger is subject to finalisation of outstanding regulatory matters and shareholder approval at the Alkane Resources extraordinary general meeting scheduled for 16 July 2020. ASM is currently anticipated to list shortly after on the ASX on July 30 (indicative date only).
- Alkane Resources shareholder are to receive one share in ASM for every five Alkane Shares held (rounded down to the nearest whole number) on the demerger record date. Ineligible Foreign Shareholders are excluded.
- Under the demerger, the Alkane and ASM entities will be separated, and no cross-holdings between companies will exist.
- ASM will be demerged with its cash reserves of A\$20 million and no bank debt.
- All interests in the Dubbo Project and associated assets (including land and water rights), together with ASM's investment in South Korean metals technology company RMR Tech Corporation (RMR Tech), will be 100% owned by ASM following the demerger. Note that ASM is a part-owner of RMR Tech, which is majority-owned by ZironTech.

Alkane Resources Chairman Ian Gandel stated:

“Since joining in February, ASM Managing Director, David Woodall, and the ASM team have focused on distilling the key value drivers for ASM and the Dubbo Project, and have brought new focus, momentum and opportunity to the team which is working hard to realise catalysts for the Dubbo Project and the ‘Clean Metal’ metallisation technology in South Korea. The demerger of ASM will provide investors two opportunities to grow value; in Alkane as a growing gold exploration, development and production company, and in ASM as an exciting critical materials business leveraged to the changing world economy.”

As a ‘rough’ guide as to what ASM’s market cap may end up being once listed we can look at current listed pure play

Australian rare earth developer Arafura Resources (ASX: ARU) which has a market cap of A\$119 million. Of course the mix and grade of critical metals and rare earths differ, so this is only a rough guide. If we value ASM based on say 10% of the 2013 DFS value of a pre-tax NPV8% of A\$1.235b, then we get a rough value of A\$123 million. This gives zero value to the extraction technology or the A\$20 million in cash.

### **Closing remarks**

Given the gold production success at Alkane Resources their massive Dubbo poly-metallic and rare earths Project was left in the shadow. The proposed demerger will help ASM to stand on their own and focus on getting their Project and processing up and running. For investors it should unlock value that was not recognized previously in Alkane Resources.

The Dubbo Project is development-ready, subject to financing, with the mineral deposit and surrounding land acquired, all major State and Federal approvals in place and extensive piloting and engineering completed. In term of financing the Australian Government (via EFA) has shown interest and we all know that the US government is also looking seriously at developing a safer rare earths supply chain and safely sourcing critical materials.

Investors in Alkane Resources will automatically get shares in the demerged company on a one for five basis. For new investors ASM is indicated to list on the ASX on July 30, 2020. It will be very interesting to see what value the market assigns Australian Strategic Materials and how it progresses from here.