24 February 2016

Scandium Market Update

Clean TeQ notes with interest the attached interview with Dr. Matthias Miermeister of Aleris International Inc. contained in an article published by *Aerospace Manufacturing and Design* on 19 February 2016. The article provides material information about the extent of the progress that has been made, and is ongoing, in respect of the development and qualification of aluminium-scandium alloys for use by the aerospace industry.

Commentary in the article confirms that an aluminium-magnesium-scandium alloy now awaits a decision by Airbus to adopt it for a program to incorporate into operating flights, as per the statement quoting Dr. Matthias Miermeister of Aleris "We are waiting for a program to pick up this technology to get it into flight status".

Clean TeQ has signed collaboration agreements with Airbus APWorks, KBM Affilips, Universal Alloy Corporation and Deakin University to promote the development and adoption of aluminium-scandium alloys for aerospace and other industrial sectors, specifically targeting an increase in the adoption of light weight scandium-aluminium alloys.

Clean TeQ is the 100% owner of the Syerston Scandium Project, one of the world's largest and highest grade scandium deposits.

For full details of the publication please follow the link below.

http://www.onlineamd.com/article/the-future-of-aircraft-metals-appears-february-2016

For more information about Clean TeQ contact:

Sam Riggall, Executive Chairman or Ben Stockdale, CFO +61 3 9797 6700

About Clean TeQ Holdings Limited (ASX: CLQ) – Based in Melbourne, Clean TeQ, using its proprietary Clean-iX® continuous ion exchange technology, is a leader in metals recovery and industrial water treatment. For more information about Clean TeQ please visit the Company's website at www.cleanteq.com.

About the Syerston Scandium Project – Clean TeQ is the 100% owner of the Syerston Scandium Project, located in New South Wales. The Syerston Project is one of the largest and highest grade scandium deposits in the world. The Syerston Scandium Project Scoping Study was completed in May 2015 – for details see the ASX announcement dated 25 May 2015.

This release may contain forward-looking statements. The actual results could differ materially from a conclusion, forecast or projection in the forward-looking information. Certain material factors or assumptions were applied in drawing a conclusion or making a forecast or projection as reflected in the forward-looking information.

Aerospace Manufacturing and Design

The future of aircraft metals appears bright

February 19, 2016
Eric Brothers

Aleris' Matthias Miermeister highlights features of his company's aluminum-magnesium-scandium fuselage sheet.

Dr. Matthias Miermeister, manager, field engineering global aerospace, Aleris Rolled Products Germany, discusses his company's new aluminum-magnesium-scandium alloy.

AM&D: What are the properties of Aleris' new aluminum-magnesium-scandium alloy?

Matthias Miermeister: When Boeing introduced the 787 Dreamliner and Airbus the A350, everyone thought the next generation of planes would be made of composites, but we have to say now that is not so. For example, Boeing's 777X will have composite wings but a metallic fuselage. We have the fourth generation of aluminum-lithium alloys where the lithium content has been reduced significantly, which offers more weight savings from density reduction. Aleris has co-developed with Airbus an alloy of aluminum-magnesium-scandium (AlMgSc) – designated AA5028 – which offers an even lower density than aluminum-lithium.

AM&D: How much lower?

MM: AlMgSc is 4% lighter than 2024 aluminum, the most-used aircraft alloy today.

AM&D: How was AlMgSc developed?

MM: The AlMgSc technology started more than 15 years ago with a German government-funded program in which Airbus participated, along with Aleris and other companies. Airbus wanted us to continue to develop AlMgSc. The first reason was its low density and lighter weight, and the second, Airbus is interested in welding technology. The A380 features laser welded panels in the lower fuselage based on 6000 series aluminum. A big advantage is that compared to typical metal fuselage, stringers are riveted to the skin. When you laser weld, you don't need a stringer

foot to put the rivet through, so you save about 30% of the stringer material. Additionally, laser welding speed is much faster than riveting.

With AlMgSc, you take a flat sheet and a straight stringer and weld it, then put it into an oven at 325°C for two hours. You get nearly 100% of the strength back. It's an annealing process. Once customers become aware of this, they believe the material can be used for applications with elevated temperatures, such as wing leading-edges heated with anti-icing devices or engine nozzle inlet lips. We are supporting this research and development activity, but our main focus target for the time being is fuselage sheet.

AM&D: Can it be substituted in new or existing aircraft?

MM: It is a full one-to-one replacement for 2024 aluminum. You can take out the 2024 and put in AlMgSc, and you have 4% weight savings without any design change.

AM&D: Any aircraft types in particular?

MM: It would not be suitable for a large-diameter fuselage, twin-aisle aircraft, where other materials would lead to a lighter design, but it would be perfect for a single-aisle airliner such as a Boeing 737 or Airbus A320. AlMgSc together with an aluminum-lithium stringer could lead to the lightest design.

AM&D: How much scandium is in the alloy? Is it expensive?

MM: The scandium component of AlMgSc is around 0.15% to 0.20% as the limits registered with the Aluminum Association.

Years ago, the main source was the Ukraine, but now there are sources for scandium in Russia, China, Australia, Canada, and even the United States.

Scandium is not rare; it is only a matter of production to get enough. AlMgSc is more expensive than 2024 aluminum, but it's more cost effective than aluminum-lithium – which requires special casting processes and making sure that the scrap is not mixed with other alloys. Also, many aluminum-lithium alloys have silver that makes them relatively expensive.

However, the manufacturing process for AlMgSc is the same as for other aluminum alloys. Aleris can cast ingots and roll to plate or sheet. AlMgSc sheets are typically produced in gauges between 1.6mm and 7.0mm (0.063" and 0.275") and supplied in annealed condition.

AM&D: What is AlMgSc's maturity level?

MM: It is not flying yet. It has almost a technology readiness level of six (TRL 6), which means ready for qualification. We are waiting for a program to pick up this technology to get it into flight status.