We make it fly
Creating a better connected, safer and more prosperous world

Sc-empowered aerospace materials – Scalmalloy® in Airbus
Workshop on critical raw materials data management & the European Scandium inventory
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At a glance

• Sc with respect to AIRBUS aerospace technologies
• Scalmalloy® - 1st tailored Al-material concept for AM
• Sc opportunities in aerospace material research
• How to accelerate Sc usage in AM
• Principal (market) availability & pricing
• Recycling & Re-use (➔ closed value streams)
• Other Sc value streams
• Final comments & acknowledgements
Sc with respect to AIRBUS aerospace technologies

• Upcoming challenges for A/C design & operation ➔ (bionic) topology optimization (Function – weight – etc.)
Sc with respect to AIRBUS aerospace technologies

• Upcoming challenges for A/C design & operation

➡ Main design drivers & techno-social-economical boundary conditions
➡ Current main primary driver in A/C manufacturing are costs (NRCs & RCs)
Sc with respect to AIRBUS aerospace technologies

• Additive manufacturing schemes are offering new opportunities
**Scalmalloy® - 1st tailored Al-material concept for AM**

- **Scalmalloy® material concept** ➔ currently only AM ➔ Commercialization by AIRBUS APWORKS

- **Metallurgically Scalmalloy® means:**
  - Rapid solidification (100 – 1.000.000 K/sec)
  - 0.1 wt% Sc ➔ Al₃Sc ➔ ~ 50 MPa strength gain

*Maiden run of the Al-3D-printed Light Rider*

*Airbus Group Chief Tom Anders (“Major Tom”) was the 1st to test it out!*

**3D-printed Scalmalloy® frame & suspension**
- E-bike with 6kW
- 120 km/h
Sc opportunities in aerospace material research

- Sc as alloying element (0.2 – 5.0%)
- Sc base metallurgy

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\begin{align*}
\text{Sc} & : 2.99 \text{ g/cm}^3 / 1541^\circ \text{C} \\
\text{Al} & \\
\text{Ti} & \\
\text{Mg} & \\
\text{Ni} & \rightarrow \text{Al/Ti/Nb modifier for } \gamma' \text{ & } \gamma''
\end{align*}
\]
How to accelerate Sc usage in AM ➔ Principal availability & pricing

• Where could Sc (or Sc compounds like Sc2O3) can from?
• What is the size of the sources?
• How many potential supplier are available (single source challenge)?
• How “green” can/will be the Sc supply chain?
• Are global political effects are influencing the Sc-supply chain (i.e. “coltan” or “blood-diamond” discussion)?
• Sc2O3 price (➔ AlSc2 masteralloy) ➔ ≤ 1000 $/kg ➔ 500 $/kg ➔ 250 $/kg

Recycling & Re-use (➔ closed value streams)

• Powder recycling for AM (under- & overspray of powder manufacturing)
• Recycling of used (contaminated) Scalmalloy® powder
Other Sc value streams

• Energy conversion (fuels cells etc.)
• Semi-conductor
• .....
• ..
Final comments

Thank you very much for your attention!

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I’m here for questions!

Sc (element 21) ➔ the opportunity for the 21\textsuperscript{st} century