Titanium Scrap Trends

Impacts of a Dynamic Market
I. Introduction to the ELG Utica Alloys Group
II. Impact of using scrap
III. Scrap Trends
IV. Impact of OEM’s controlling their Revert
V. Role of Scrap Processors in today’s market
VI. What happens when scrap flows change?
VII. Revert Melting outside of the US (Europe, Japan)
Topic I

Introduction to the ELG Utica Alloys Group
ELG UTICA ALLOYS – A leading company in state of the art certified processing of Titanium and Superalloys turnings and solids

Full analysis of all elements and trace elements with in-house labs

Controlled and certified mutilation of life limited parts and in-house recovery of precious metals

Global Revert Management Programs
- 12 locations in six countries plus On-Site-Service
- Another 34 facilities of the ELG Group in the US, Europe and Asia for service and logistics solutions
Local presence, global collection and worldwide service for a better recycling loop
Our mission

**Service**
Providing processing and trading of Titanium and Superalloys as well as scrap related services

**Global Reach**
Global Scrap collection and processing network

**Technology**
Cost & Quality Leadership through constant development of processing Technology and proactive Commercial Team
Topic II

Impact of using Scrap
Energy Savings and minimalizing the environmental impact

Using solely Scrap as the primary source of raw materials for the production of Titanium ingots will reduce the energy consumption and the related CO² emissions by 95.4%.
Types of Scrap and their Impact

- Bulk-Weldable
- Feedstock
- Turnings
Topic III
Scrap Trends
Raw Material Value Trends

![Graph showing raw material value trends from 2013 to 2018. The graph compares prices for various titanium scrap types: Ti64 BW $/lb, Ti64 Chip $/lb, CP2 Clip $/lb, Sponge $/lb, and Fe-Ti Scrap $/lb.](image-url)

Major Factors in Scrap Availability

- Buy-To-Fly of parts to scrap
- Scrap Consumption Ratio (incorporation rate)
- Fe-Ti or Steel Grade Percentage of Scrap Generated

Assuming 8:1 By-To-Fly, 40% Fe-Ti Rate, and 56% Scrap Consumption

<table>
<thead>
<tr>
<th>Ingot</th>
<th>Buy to Fly</th>
<th>Scrap</th>
<th>Fe-Ti Ratio</th>
<th>Vacuum Ratio</th>
<th>Incorporation</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>61,800</td>
<td>0.875</td>
<td>54,075</td>
<td>21,630</td>
<td>32,445</td>
<td>34,608</td>
<td>(2,163)</td>
</tr>
</tbody>
</table>

Assuming 8:1 By-To-Fly, 40% Fe-Ti Rate, and 50% Scrap Consumption

<table>
<thead>
<tr>
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<th>Scrap</th>
<th>Fe-Ti Ratio</th>
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<td>32,445</td>
<td>30,900</td>
<td>1,545</td>
</tr>
</tbody>
</table>
VAC Incorporation and Vacuum Scrap Produced

Assumes:
- 61,800 MT Ingot Production
- 8:1 Buy to Fly Ratio
- 60% Scrap Generation is VAC
Topic IV
Impact of OEM’s controlling their Revert
Topic V
Role of scrap processors in today’s market
Most of the melting capacity for Titanium scrap is concentrated in the North America (largest capacity worldwide) with new projects in Europe, Japan and China…..

Scrap has to sourced globally but supplied locally – Sophisticated logistic solutions are needed to secure scrap volumes generated emerging manufacturing clusters
ELG Utica Alloys’ reach in North America

Distance between the farthest two points – 4,550 km

Distance between the farthest two points – 1,360 km

70%+ of US Melt Capacity
ELG Utica Alloys’ reach in Asia

Distance between the farthest two points – 6,120 km

Distance between the farthest two points – 2,935 km
ELG Utica Alloys’ reach in Europe

Distance between the farthest two points – 3,174 km

Distance between the farthest two points – 4,970 km
Topic VI
What happens when scrap flows change?
US Scrap Consumption


2017 data pro-rated from Q1-Q3 reporting.
Scrap Flows

Scrap Shipments to US

Source: USGS (http://minerals.usgs.gov/minerals/pubs/commodity/titanium/)

2017 data pro-rated from Q3/Q4 reporting.
World Steel Production

Source: World Steel Organization: www.worldsteel.org
## Top 10 steel-producing countries

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>2016 (Mt)</th>
<th>2015 (Mt)</th>
<th>2016/2015 %</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>China</td>
<td>808.4</td>
<td>798.8</td>
<td>1.2</td>
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<tr>
<td>2</td>
<td>Japan</td>
<td>104.8</td>
<td>105.1</td>
<td>-0.3</td>
</tr>
<tr>
<td>3</td>
<td>India</td>
<td>95.6</td>
<td>89</td>
<td>7.4</td>
</tr>
<tr>
<td>4</td>
<td>United States</td>
<td>78.6</td>
<td>78.8</td>
<td>-0.3</td>
</tr>
<tr>
<td>5</td>
<td>Russia</td>
<td>70.8</td>
<td>70.9</td>
<td>-0.1</td>
</tr>
<tr>
<td>6</td>
<td>South Korea</td>
<td>68.6</td>
<td>69.7</td>
<td>-1.6</td>
</tr>
<tr>
<td>7</td>
<td>Germany</td>
<td>42.1</td>
<td>42.7</td>
<td>-1.4</td>
</tr>
<tr>
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<td>Turkey</td>
<td>33.2</td>
<td>31.5</td>
<td>5.2</td>
</tr>
<tr>
<td>9</td>
<td>Brazil</td>
<td>30.2</td>
<td>33.3</td>
<td>-9.2</td>
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<tr>
<td>10</td>
<td>Ukraine</td>
<td>24.2</td>
<td>23</td>
<td>5.5</td>
</tr>
</tbody>
</table>

Source: World Steel Organization: www.worldsteel.org
Topic VII

Revert melting out of the US (Asia, Europe)
Overview revert activities in France, Germany, Japan and Russia

- France: A joint venture between Aubert & Duval, UKAD, ADEME (Energy), CACF (Finance) began qualification in 2017, with Industrial Production beginning in 2018

- Germany: Permanent closure of the VDM Melting facility in Essen

- Japan:
  - a joint venture between Nippon Steel and Sumitomo Metal Corporation (NSSMC) has an agreement to supply SAFRAN
  - Kobe Steel began supplying GE with Ti64 Forgings in 2017

- Russia: Increasing scrap generation due to partnerships with OEM’s delivering finished and semi-finished parts. Utilization of Skull Furnaces will enable VSMPO to recycle domestic scrap that was previously available in the EU and USA
Summary

I. Introduction to the ELG Utica Alloys Group
   - Global presence, technical expertise, customer focus.

II. Impact of using scrap
    - Environmentally and Financially advantageous.

III. Scrap Trends
    - Demand has been on a steady increase since the beginning Q4 2016.

IV. Impact of OEM’s controlling their Revert
    - Provides stability of supply, in exchange for complexity of management.

V. Role of Scrap Processors in today’s market
    - Ongoing shift from Trading activity to Business Partner and Logistical Solutions.

VI. What happens when scrap flows change?
    - Shifting generations of scrap will change the market and the production of Titanium.

VII. Revert Melting outside of the US (Asia, Europe)
    - Technical expertise and new players in Aerospace will increase competition and opportunities for new entrants.
Thank you for your attention!