Titanium Opportunities in Additive Manufacturing

Description:
This new specialty market report is the first of its kind to explore opportunities and considerations specifically for titanium and titanium alloys. Titanium is becoming one of three premiere metal group opportunities for additive manufacturing systems of numerous types, sought after primarily for its high strength to weight ratio, biological inertness, and other desirable properties when combined with additive layer manufacturing.

As a specialty study in a specific material, this report presents both market forecast data as well as critical market analysis for use of titanium in key industries adopting AM, as well as considerations for the future adoption and use in other applications. The primary opportunity factors related to the broader supply chain, primary providers of AM titanium powder and other forms, and analysis of the print technologies and powder production processes all combine to help business development and strategy professionals determine how to focus their efforts in titanium powder, parts, and print technologies.

Titanium is increasingly sought after in AM for its high strength to weight ratio, biological inertness, and other desirable properties. This report provides ten-year forecasts – in US$ Millions and Kilograms – for titanium in the following sectors, aerospace, automotive, jewelry, dental, medical, service bureaus, and ‘other adopting industries’. Other applications discussed include heavy equipment, marine, energy, and consumer products. The author’s projections also provide breakouts by Ti6Al4V and other titanium alloys.

This report also profiles titanium-related product/ market strategies of leading firms discussed include: 3D Systems, Arcam, Concept Laser, EOS, ExOne, Farsoon Fonon, GE, GKN Hoeganaes, Honeywell, i.Materialise, LPW, Matsuura, Metalysis, Optomec, Oxford Performance Materials, Phenix, Ping, Praxair, Puris, Realizer, Renishaw, Sisma, SLM Solutions, Tekna, and Xi’an Brightlaser

Highlights from the Report:
AM titanium will continue to be used where premium performance is required. In the short term, the supply chain for AM titanium powder will continue to be controlled by smaller specialty providers – but larger global metal firms are now beginning to jump in. These firms have historically sold to metal AM system vendors, however today several very large users of metal AM in aerospace and medical are ordering in volumes large enough to sustain smaller powder providers.

The vast majority of titanium powder used in current additive manufacturing systems falls into two types—Ti6Al4V (Ti64) and commercially pure titanium (CPT).

Increased use of specialty titanium alloys is expected to vary depending on adopting industry.

Titanium is being explored for smaller structures in aircraft engines such as brackets and housings, but may expand into much larger structural components to drive demand. By 2020, aerospace will be consuming almost 155,000 Kgs of titanium. Most available specialty Titanium alloys today have been developed primarily with aerospace in mind.

Titanium also has good prospects in medical markets due to bio-inertness, and ‘as manufactured’ bone ingrowth performance. It also is capable of outperforming heavier alloys with its strength to weight ratio. Current production of titanium orthopedic implants using AM is growing rapidly across the board, with new products in spine, hip, knee, and other orthopedic areas. Medical applications of AM titanium will account for around 274,000 Kg of Titanium in 2020 thanks to this growth.

Contents:
Chapter One: State of Metal Additive Manufacturing in Key Markets
  1.1 Key Trends in Metal Additive Manufacturing Influencing Demand for Titanium
  1.1.1 Development of Quality Assurance Initiatives in Metal AM
  1.1.2 Development of Part Testing Processes for Titanium Components made via Metal AM
  1.2 Metal AM and Titanium in Aerospace
  1.2.1 Titanium Helping to Move Metal AM Beyond Aircraft Engines
Chapter One: Additive Manufacturing Utilization of Titanium Metal Powders

1.2.2 Titanium in Space Applications
1.2.3 Total Aerospace Titanium Opportunity May Leave Room for New Alloys
1.3 Metal AM and Titanium in Medical
1.3.1 Powder Bed Fusion in Implants Increasingly Fragmented, Hold Implication for Titanium Powder Production
1.3.2 Competition in Orthopedic Implants from Outside the Metals Segment
1.3.3 Titanium in Dental Applications
1.4 Metal AM and Titanium in Automotive
1.4.1 Use of Titanium in Performance Motorsports
1.4.2 Critical Factors for Breaking into Commercial Vehicle Segments
1.4.3 Future of Titanium 3D Printing in Automotive
1.5 Metal AM and Titanium in Other Potential Industries
1.5.1 Heavy Equipment Industries — Maritime and Energy
1.5.2 Consumer Products
1.6 Comparisons to Powder Metallurgy and Broader Metal Powder Manufacturing
1.7 Key Points from this Chapter

Chapter Two: Additive Manufacturing Technologies and Utilization of Titanium Metal Powders

2.1 Primary Titanium Powder Characteristics for AM Technology
2.1.1 General Requirements for Spherical Titanium Metal Powders for AM
2.2 Metal Powder Bed Fusion Technology and Related Metal Powder Production Considerations
2.2.1 Laser-Based Metal Powder Bed Fusion
2.2.2 Electron Beam Based Metal Powder Bed Fusion
2.3 Blown Powder Directed Energy Systems and Related Metal Powder Production Considerations
2.4 End User Considerations for Titanium Powder in Additive Manufacturing
2.5 Key Points From this Chapter

Chapter Three: Analysis of Titanium Powders for Additive Manufacturing – Production Methods, Players, and Supply Chain

3.1 Supply Chain Considerations for Titanium Powder
3.2 Production Methods for Titanium Powder for AM
3.2.1 Gas-Based Atomization Methods
3.2.2 Plasma-Based Atomization Methods
3.2.3 Emerging AM Powder Production Methods
3.3 Competing Titanium Materials in the AM Industry
3.3.1 Titanium versus Nickel Superalloys, Cobalt Chrome, and Aluminum in AM
3.4 Profiles of Current and Potential Future Providers of Titanium Products to the AM Market
3.4.1 AP&C
3.4.2 GKN Hoeganaes
3.4.3 LPW Technology
3.4.4 Metalysis
3.4.5 Praxair Surface Technologies
3.4.6 Puris LLC
3.4.7 Tekna

Chapter Four: Summary of Ten-Year Forecasts for Titanium Powders in Additive Manufacturing

4.1 Methodology Review
4.2 Metal 3D Printing Hardware Forecasts
4.2.1 Annual Unit Sales and Market Growth
4.2.2 Install Base
4.3 Titanium Powder Demand and Revenues by Vertical Industry
4.3.1 3D Printed Titanium in Aerospace
4.3.2 3D Printed Titanium in Automotive
4.3.3 3D Printed Titanium in Medical
4.3.4 3D Printed Titanium in Dentistry
4.3.5 3D Printed Titanium in Service Bureaus, Jewelry, and Other Applications

Acronyms and Abbreviations Used In this Report

List of Exhibits
Exhibit 1-1: Top Short Term 3D Print Material Opportunities for Commercial Aerospace and General Aviation
Exhibit 1-2: Total Titanium Mix in Aerospace 3D Printing Applications – Multi-Year Evolution
Exhibit 1-3: Beneficial Traits of 3D Printed Orthopedic Implants
Fax Order Form
To place an order via fax simply print this form, fill in the information below and fax the completed form to 646-607-1907 (from USA) or +353-1-481-1716 (from Rest of World). If you have any questions please visit http://www.researchandmarkets.com/contact/

Order Information
Please verify that the product information is correct and select the format(s) you require.

<table>
<thead>
<tr>
<th>Product Name:</th>
<th>Titanium Opportunities in Additive Manufacturing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web Address:</td>
<td><a href="http://www.researchandmarkets.com/reports/3496339/">http://www.researchandmarkets.com/reports/3496339/</a></td>
</tr>
<tr>
<td>Office Code:</td>
<td>SCPLIRXO</td>
</tr>
</tbody>
</table>

Product Formats
Please select the product formats and quantity you require:

<table>
<thead>
<tr>
<th>Quantity</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic (PDF) - Single User:</td>
<td>USD 3200</td>
</tr>
<tr>
<td>Electronic (PDF) - 1 - 5 Users:</td>
<td>USD 3700</td>
</tr>
<tr>
<td>Electronic (PDF) - Enterprisewide:</td>
<td>USD 4200</td>
</tr>
</tbody>
</table>

Contact Information
Please enter all the information below in **BLOCK CAPITALS**

<table>
<thead>
<tr>
<th>Title:</th>
<th>Mr [ ] Mrs [ ] Dr [ ] Miss [ ] Ms [ ] Prof [ ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Name:</td>
<td>___________________________</td>
</tr>
<tr>
<td>Email Address:</td>
<td>* ___________________________</td>
</tr>
<tr>
<td>Job Title:</td>
<td>___________________________</td>
</tr>
<tr>
<td>Organisation:</td>
<td>___________________________</td>
</tr>
<tr>
<td>Address:</td>
<td>___________________________</td>
</tr>
<tr>
<td>City:</td>
<td>___________________________</td>
</tr>
<tr>
<td>Postal / Zip Code:</td>
<td>___________________________</td>
</tr>
<tr>
<td>Country:</td>
<td>___________________________</td>
</tr>
<tr>
<td>Phone Number:</td>
<td>___________________________</td>
</tr>
<tr>
<td>Fax Number:</td>
<td>___________________________</td>
</tr>
</tbody>
</table>

* Please refrain from using free email accounts when ordering (e.g. Yahoo, Hotmail, AOL)
Payment Information

Please indicate the payment method you would like to use by selecting the appropriate box.

☐ Pay by credit card: You will receive an email with a link to a secure webpage to enter your credit card details.

☐ Pay by check: Please post the check, accompanied by this form, to:
Research and Markets,
Guinness Center,
Taylors Lane,
Dublin 8,
Ireland.

☐ Pay by wire transfer: Please transfer funds to:

<table>
<thead>
<tr>
<th>Account number</th>
<th>833 130 83</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sort code</td>
<td>98-53-30</td>
</tr>
<tr>
<td>Swift code</td>
<td>ULSBIE2D</td>
</tr>
<tr>
<td>IBAN number</td>
<td>IE78ULSB98533083313083</td>
</tr>
<tr>
<td>Bank Address</td>
<td>Ulster Bank, 27-35 Main Street, Blackrock, Co. Dublin, Ireland.</td>
</tr>
</tbody>
</table>

If you have a Marketing Code please enter it below:

Marketing Code: ______________________

Please note that by ordering from Research and Markets you are agreeing to our Terms and Conditions at http://www.researchandmarkets.com/info/terms.asp

Please fax this form to:
(646) 607-1907 or (646) 964-6609 - From USA
+353-1-481-1716 or +353-1-653-1571 - From Rest of World