Meeting the Demand Challenge  
Jim Buch  
Vice President – Commercial  
TIMET

Demand Drivers
Several global trends are driving growth in current and emerging titanium market.  
• Oil demand and stability of supply are driving planned oil exploration in more challenging environments. Weight, corrosion resistance, and modulus characteristics of titanium are closing the value gap with other metals and resulting in significant growth potential.  

• The need for performance, efficiency, and environmental stewardship are moving the transportation segment toward titanium in the areas of under the hood automotive parts and airframe structures. Weight, temperature, strength, and temperature performance are opening up huge opportunities for titanium.  

• Expectations around GDP growth and continued expansions in China and India along with other developing areas are driving optimism in power generation, desalination, chemical processing, and transportation.  

• While global tension and potential conflicts will potentially depress the world economies and because aerospace continues to be the key driver for our industry, the overriding result in escalation is undoubtedly negative. However, current and future military strategy leading to light armament and mobility favor the use in titanium due to light weight and ballistics.  

Titanium Mill Product Demand Projected to Double Over Ten Year Period  
Based on feedback from our customer in each of these segments, demand is expected to double over a ten year period. This chart represents TIMET’s estimate of world demand for mill products into the middle of the next decade assuming the average GDP is 4-5% in the near term and 3% in the long term. As you can see, we have taken a very conservative estimate on emerging market growth comprised of mainly known opportunities in the area of oil and gas, consumer and automotive. The industrial segment, driven mainly be energy, desalination, chemical processing, is projected at GDP growth. The military projection includes air, ground, and naval and attempts to quantify several known programs including the reduction of several legacy programs such as the C-17 and the expansion of programs such as the A-400M and the JSF. Obviously the critical growth segment continues to be aerospace driven by GDP assumptions, geographical expansion particularly in India (per recent announcement) and China, and the increased content of titanium on airframe.  

Industry is investing in Sponge and Melt to support growth
This chart attempts to look at how the industry is doing in meeting the demand challenge. The left chart shows the metal unit demand in white and attempts to capture the current and announced expansion by geographical region (I will name some of the
big ones according to publication). As you can see the industry has been very responsive to the demand expectations and the investment for the remainder of the decade is expected to exceed 2 Billion dollars. However, even with this activity, demand is still outstripping supply in the long term. Please note that in our analysis that we have assumed revert to play a bigger role increasing from an estimated 25% of metal units to nearly 35% in 2010 and 2012.

The chart on the right looks at the demand versus melt capacity by furnace type. Again, the volume in 2010 includes the announced expansions (I will name a few big ones). The industry is moving quickly however as long term demand is still outpacing supply. Also note that the expansion of VAR capacity is exceeding the expansion of CHM technology.

Revert and Yield Assumption Critical to Industry Growth
One of the important elements driving the industries ability to meet demand will be our ability to capture and process scrap through mill products as efficiently as possible. What supply will be available and in what form? We know the industry is globalizing and therefore parts are being forged and machined in increasing volumes in expanded geographies. How to recapture that scrap, storage and transportation, and where to melt the scrap are key components. How to maintain quality of the revert to support a broad range of mill products is also critical.

We see demand being driven to a large degree by aerospace structural and engine parts. These items generally yield high levels of revert in the form of chip. As shown on the previous page, the ratio or VAR expansion appears to be exceeding the CHM expansion. VAR melt depends primarily on solids and sponge. CHM is much more versatile in processing a large variety of revert types. Right sizing the chip and CHM capabilities is an important consideration.

Other changes that may impact supply balance include technology to improve yields such as EBSM, welding technology, machining advancements and near net forgings. Other technology changes enable higher revert utilization such as the move by the engine producers to use rotor grade billet produced out of chip and bulk revert rather than sponge.

Critical to maintain aerospace quality for supply and value.
This chart shows the pricing (as reported by Metal Prices.com) for 6-4 chip as sold into both the aerospace industry (blue) and the Ferro ti industry (yellow) driven mainly by automotive build rates. The red line shows the delta between the two prices. Over the last several years we have seen the ferro ti price remain fairly close to the aero chip price. However, two key changes must be considered in the future. First, the amount of sponge coming on line is expanding quickly as shown previously. The creation of off-grade or lower quality sponge will continue since most of the expansion is based on the kroll process. This will cause an over supply of available metal units into the much slower growing automotive industry driving a separation between aero grade and ferro ti. This will be further aggravated by the amount of chip generated by aerospace
machining ... again at a much higher rate than automotive demand. To the generators and sellers of chip ... it is more important than ever to protect the integrity of your revert in order to support the value of the chip for re-melting aero grade ingot.

**Technology changes enabling higher scrap incorporation**

Over the last 20 years or so there has been a steady increase in CHM technologies, notably EB and also PAM, contributing to our industry output. Starting with commercially pure grades for industrial applications and over the past decade for the critical aero-engine component manufacture where today approx. 25% of material is now CHM. These technologies capitalize on availability of scrap in all forms from chip through to retired parts. These processes can tolerate lower cost scrap inputs and high incorporation rates e.g. the use of non X-rayed chip and provide the necessary quality for high integrity components such as engine discs, impellors and blades. Such has been the performance and revolutionary controls on EB that the industry is considering the use of EB only for aerospace applications for future make with AMS specification established last year and customer specific specs. being generated.

**Conclusion**

- Demand is doubling
- Investment in sponge, melt, and mill conversion is critical to the health of the industry
- Revert plays a key role in right sizing the raw material supply
- Maintaining aero quality revert will be critical to the supply and value of mill products.
- Right sizing CHM capacity will be critical as chip availability grows with aero demand
- Continued acceptance of CHM in broader and more critical applications will enable further chip consumption
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Jim Buch
Vice President – Commercial
Titanium Metals Corporation

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Demand Drivers

- Energy cost
Demand Drivers

- GDP and Geographical Expansion
Demand Drivers

- Military Strategy
Titanium Mill Product Demand Projected to Double Over Ten Year Period

- Emerging market growth based on known programs
- Industrial growth at GDP
- Military slight growth due to impact of current programs
- Commercial Aerospace growth based on industry projections and assuming successful adoption of titanium / composite structures
Industry is Investing in Sponge and Melt Capacity to Support Growth

Sponge Investment

Metal Unit Demand

Revert

Europe / Russia

Japan

China

N. Am.

2005 2010 2015

Melt Investment

Melt Demand

EB

Plasma

VAR

N. Am.  China  Japan  Europe / Russia  Revert

2005 2010 2015

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Revert Utilization Critical to Growth

- How much supply, what form, what quality and from where?
- What equipment will be needed to process?
- How will the demand change due to yield and technology?
Technology Changes Enabling Higher Revert Incorporation

Cold Hearth Melting (EB/Plasma)
- Flexible use of revert
  - Since 1986 CHM has been the primary method for production of CP titanium grades
  - Growing capability to produce alloy grades increasing further utilization of revert
- Increased aero-engine usage
  - Since introduction in 1988, use in rotating parts has increased to ~25% of segment
  - Qualification of rotating parts continues to expand
- AMS 6945 (EB Only) issued in Summer 2005

![Diagram showing production levels from 1994 to 2009 for Alloy and CP]
Conclusion

- Titanium mill product demand forecasted to double
- Investment in sponge, melt, and mill conversion critical to health of industry
- Maintaining aero quality revert important to right sizing raw material supply
- Right sizing CHM capacity important as revert availability grows with aero demand
- Continued acceptance of CHM in broader and more critical applications will enable further revert consumption

Thank You