An outlook for titanium metal

Thomas Hohne-Sparborth
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80% of the production of titanium sponge dedicated to the production of titanium mill products

Scrap ratio in melted products estimated at 20%
20% of melt product output based on scrap feedstock, up dramatically from 2011/2012

- Scrap ratio fell in mid-to-late 2000s owing to an increase in melt output and low scrap use in China

- Sponge production peaked in 2012, with scrap ratio falling to 5-7% in 2011 and 2012

- Low prices of scrap and upgrade of Chinese capacity contributed to sharp increase of scrap ratio

- Increased integration means more scrap generated and consumed in-house
Sponge supply trends
Sponge output peaked in 2012, but fell as a result of destocking and lower prices; reaching 186kt in 2016

- After USSR’s collapse, output recovered from mid-1990s with increases in FSU, USA and Japan
- New period of high growth from 2000s driven by China; interrupted by 9/11 in 2001, and global downturn in 2009
- Peak in 2012 owing to rising aerospace and industrial demand, and concern over feedstock
- Buildup of inventories and overcapacity led to sharp drop to 2014
Sponge production is highly-concentrated, with top four producers accounting for 53% of production in 2016

- Outside of China, production is dominated by VSMPO, Osaka Titanium, Toho Titanium, Timet, ZTMK and UKTMP

- VSMPO is the world’s largest producer. Most sponge used in-house for ingot/mill production, but some material sold externally

- Around 30-40% of Osaka’s output is exported, slightly less for Toho

- China’s five largest producers had output of around 10kt each in 2016, similar to Timet
Exports of sponge have declined from 2012 to 2016, owing to increased use of scrap and domestic processing.

- Only some countries report trade in titanium sponge separate from unwrought titanium and powders.
- Trade peaked in 2012 at around 66kt, but has since declined to a low of 35kt in 2016.
- Main trade flows are from Japan, Russia, Ukraine and Kazakhstan to the USA, EU and South Korea (where it is used mainly for FeTi).
- China’s small trade flows are the result of vertical integration, melting sponge domestically.
Exports of sponge are typically fairly stable, but recent months have shown some signs of growth.
Scrap supply trends
Scrap consumption is concentrated in the USA but remains variable, depending on both availability and price.

- Scrap may be divided into new scrap, generated during machining, and old scrap, generated at end-of-life.
- Most scrap used in production of secondary ingot and slabs by five companies in the USA; 51kt recycled in 2016.
- The scrap ratio and consumption of titanium scrap in the USA fell in mid-2000s as prices of scrap increased.
- Steep increase from 2012 largely for re-melting purposes and benefiting from low prices.

Source: USGS
Reported exports increased to 55kt in 2016, following strong growth since 2013 as scrap ratios have increased.

- Reported trade statistics for titanium waste and scrap include a wide range of materials with varying titanium content.

- Trade is split between higher-grade scrap for re-melting, and lower-grade scrap for consumption in steels, often via FeTi production.

- In gross weight terms, trade declined in 2000s from a peak of 43kt down to 21kt in 2009, but has since recovered.

Full data upon request.
Trade in waste and scrap is dominated by the EU (including imports into France and the UK) and the USA.

- Higher-grade is mostly imported by the USA, France and Japan, originating in other parts of Europe, Japan and Canada.
- Lower-grade scrap is generated in the same regions as well as the USA, but imported by the UK, Estonia and Canada.
- Once again, China’s role in trade in waste and scrap is limited, as most of its production is based on domestic supplies of sponge and scrap.
Like exports of sponge, there has been an upwards trend in scrap exports since early 2017
Melted products
Output of melt products recovered in 2016 to 199kt; China will soon overtake the USA as the largest producer

- Production of melt products typically exceeds sponge output because of the use of scrap, particularly in the USA and Russia

- 12 countries have melt production, including some (in the EU) with no domestic sponge production

- Output increased rapidly in early 2000s, dropped during the 2009 downturn, and peaked in 2012.

- After a drop in demand (mainly in industrial uses), output recovered in 2016 to 199kt
There is no bottleneck in melt capacity, as capacity in China has increased and utilisation remains low

- Capacity remains well in excess of production; estimated at 447kt in 2016 (45% capacity utilisation)

- Fluctuation in Russian capacity attributable to expansions, decommissioning

- Vacuum arc remelting (VAR) remains, by far, the most common production route, accounting for 72% of installed capacity

- EBM capacity is growing to process increasing volumes of scrap
51 companies (28 in China) operate 59 plants in 12 countries; nearly all recent additions now in China

- VSMPO is the largest single producer, accounting for 17% of 2016 production
- Jointly, Chinese producers account for approximately 30% of the market
- In the USA, the main producers include Timet, ATI, and RTI
- Market shares have shifted slightly in favour of China and the USA since 2011
Mill products
Mill product output has typically followed similar trends to sponge and mill output, and reached 148kt in 2016.

- Mill product output in 2016 was estimated at 148kt, compared with 199kt for melt products.
- Difference is accounted for by the production of ferrotitanium (and titanium powders).
- Production has kept pace with demand trends, and has grown at a CAGR of 4.4% since 2006.
- After a period of oversupply in 2011/2012, market approximately in balance; now some industrial challenges in ramp-up.
Owing to vertical integration, market shares of mill and melt production are roughly similar

- China, the USA, Russia and Japan together account for over 90% of total output of mill products

- Some producers have upstream integration through to sponge, whereas producers in the UK, France, Germany, Italy, Ukraine and India only have melt capacity

- Russia has regained some of its market share which it lost in the early 1990s, at the expense of the USA and Japan
Exports declined in 2013 and 2014, but have since recovered to the 2012 peak level of 85kt

- Reported under the HS trade code for “titanium and articles thereof”

- Trade in mill products is four times as large as melt product trade, reflecting the geographical diversity in melt product use

- Trade peaked in 2012 and 2016 at around 85kt

- The USA is the largest exporter, followed by the EU, Russia, Japan and China. Import destinations are highly-diversified.
Major regional divisions remain in terms of the breakdown of demand; Chinese aerospace use likely to grow

- Growth in production and demand from China has partially masked another major transition in the market

- Since the 1990s, consumption has shifted from military to civilian uses

- Aerospace uses in airframes and engines is the single largest end market, accounting for 66kt of consumption.

- Industrial uses, combined, account for about 68kt
Notwithstanding near-term constraints in mill products, some longer-term increases required in minerals market.

- Tightening market
- Near-term constraints
- End-of-life scrap increasing
  - Main growth drivers
    - Civilian aerospace
    - Military and spaceflight
    - Chemical
    - Power
    - Other industrial
    - Shipbuilding
    - Oil and gas
    - Metallurgy
    - Desalination
    - Construction
    - Automotive
    - Consumer and medical

- Plenty of capacity
- Expected increase to balance sponge
Strong demand growth for titanium minerals expected, with share accounted for by metal expected to grow

- Share of consumption of titanium minerals for use in metal expected to increase from 5% in 2016, to 8% by 2025
- Rutile the main feedstock used in sponge production, but some “upgraded” ilmenite concentrates (with >95% TiO2) also used
- When demand booms, sponge metal producers compete against pigment market for scarce supplies of rutile
- Contributes to increased price volatility in rutile market

![Graph showing consumption of titanium minerals](image-url)
Strong demand growth for titanium minerals expected, with share accounted for by metal expected to grow

- 20 new projects identified, with combined capacity of 3.41Mt but likely to add about 1.18Mt in TiO₂ feedstock by 2025
- Deficit expected in titanium minerals market, but significant stocks remain to absorb impact
- *Rutile* output expected to grow faster; 14 out of 20 projects produce rutile
- Downstream stockpiles further help reduce impact
The outlook for demand for titanium remains healthy, with growth expected to speed-up in the mid-2020s

- Mill product demand is forecast to increase from 150kt in 2016 to 213kt by 2026, at a CAGR of 3.6%.

- Currently some deficit in supply, likely to affect actual consumption levels in 2017/2018

- Aerospace is likely to overtake industrial applications, increasing at a CAGR of 5%, driven by both civil and military uses

- Consumer and medical applications in particular are likely to have a strong growth outlook
Tightness in the market for titanium minerals and higher scrap generation are likely to increase the scrap ratio

- Despite surplus capacity in sponge plants, strong demand for feedstock may create some tightness in the minerals market.

- Expected to be met by new production from rutile projects, stockpiles, and scrap.

- Availability of new and old scrap is expected to increase, owing to higher historical consumption and vertical integration.

- Roskill forecasts that the scrap ratio is likely to increase to 30%, with sponge and scrap reaching 199kt and 85kt respectively.
Roskill’s new Titanium Market Outlook to 2026 has just been published; Titanium Minerals report also available

- Review of trends and outlook for all the major applications of titanium

- Analysis of titanium uses in aerospace, including military models, impact of additive manufacturing, and spaceflight

- Company profiles for 24 producers and their subsidiaries

- Country-by-country industry reviews

- Production statistics by country and company for sponge, melt and mill products

- Price outlook to 2026, including upside and downside scenarios
Questions and more information

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Contact:
Mr. Thomas Hohne-Sparborth
+44 (0)20 8417 0087
ths@roskill.co.uk