Low Cost Processing to Produce Spherical Ti-6Al-4V Powder

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How is Spherical Titanium Alloy Powder Produced

Sponge → melt and alloy → cast into large billets → breakdown large billet into small pieces → melt small piece/billet and gas blow spherical titanium alloy powder

Cost of spherical titanium alloy powder is approximately 40 times cost of sponge.
How is Spherical Titanium Alloy Powder Produced

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New Processing to Produce Titanium Alloy Powder

1. sponge or electrolytic powder → Plasma Transfer Arc (PTA) Melt → alloying elements
2. gas blow spherical powder

Cost is projected at 3 to 5 times cost of sponge and alloying elements (13 to 8 times lower cost than present spherical alloy powder cost).
MER Processing to Produce Low Cost Titanium

Subtotal: Reduced Cost Compared to Standard Kroll

Subtotal: Approx. 2X Reduced Cost

Total: Approx. 4X Reduced Cost
Low Cost Ti Alloy Production Methods

Electrolytic Powder in Residual Salts

OR

Flash Evaporate Residual Salts and Recycle

Sponge in Residual MgCl₂/Mg

Spheroidize Powder

Additive Layer Manufacturing

Powder Metallurgy Processing

Net Shapes

Near Net Shapes

Plasma Transferred Arc (PTA) Continuous Melter

Slab

Circular Ingot

Near Net Shape

Net Shapes

Near Net Shapes
Processing to Produce Low Cost Spherical Ti Alloy Powder

- Continuously produced low cost electrolytic titanium
- Flash evaporated and recycled residual salt from electrolytic titanium
- Plasma melted electrolytic titanium
- Alloying elements

Spherical Powder

Products at Approx. 4-5X Kroll Sponge
Low Cost Processing to Produce Spherical Ti Alloy Powder
Spherical Titanium Alloy (Ti-6Al-4V) Powder by Low Cost Processing
Powder Microstructure

Fine martensitic structure within powder particles

V-rich cell boundaries
(3.2%V vs 2.2%V in matrix)
Powder Chemistry

Analysis of powder chemistry via EDS
(semi-quantitative analysis)

Average: Ti-10.5%Al-2.5%V
Range: Ti – (7-11%Al) – (2-3.5%V)