TITOMIC

MANUFACTURING INNOVATION MADE REALITY

Introduction to Titomic

October 2023

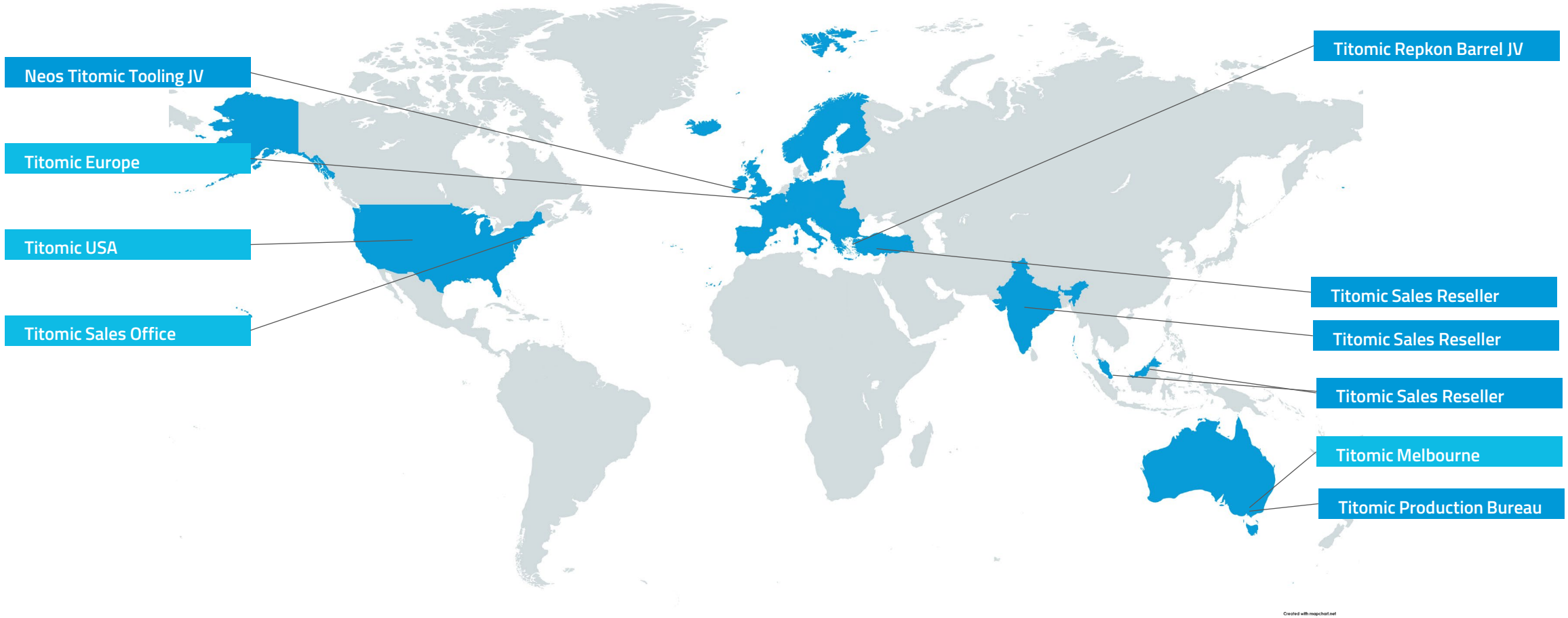
Who is Titomic

Making tomorrow possible

- Cold Spray experience spanning 15+ years
- Advanced manufacturing innovator & partner for 15+ years
- Standalone & turnkey machines, systems, production, training, support and more
- Proven applications across additive manufacturing and coating and repair
- Integrator of leading Cold Spray Systems
- Manufacturer of In-house Systems
- ISO 9001, AS 9100, ISO 27001 Certified

Taking our technology to the world – Global footprint

Global production, supply and service network to meet our customer's needs.

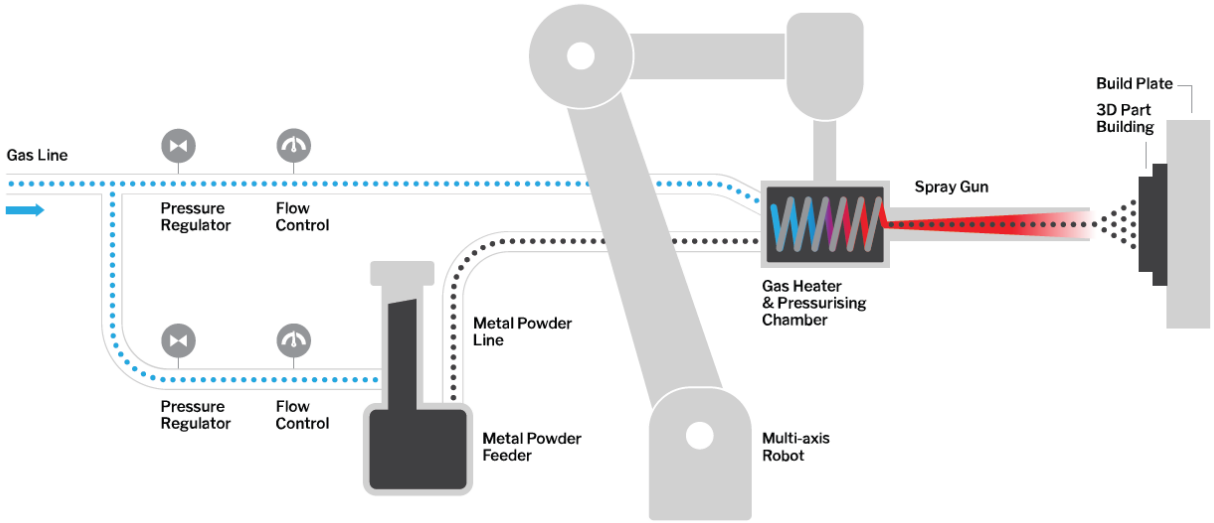


Main Place of Business

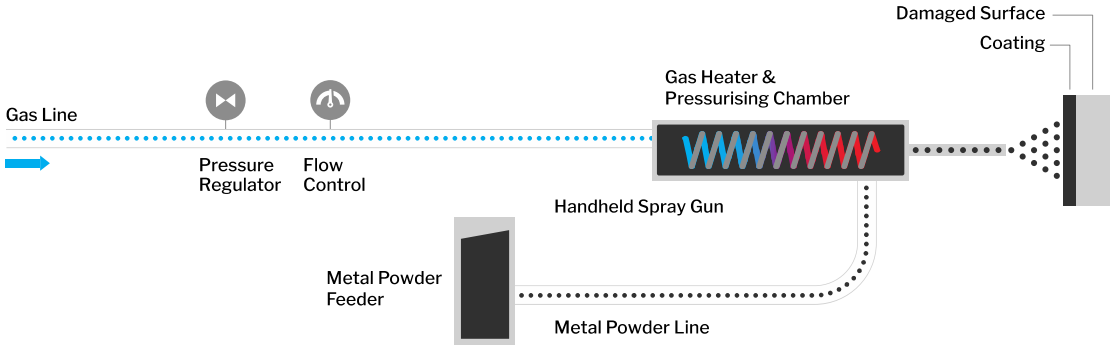
Bureaus JV / Cooperation

Our cold spray process

Robotic High-Pressure System for AM



Low to Medium Pressure System for Coating and Repair



Our story

- Founded in 2014 to commercialise cold gas spraying metal particles to produce 3D structures
- Now the only globally active, publicly listed cold spray solutions company
- Our cutting-edge technology and systems are changing manufacturing for the better

Titomic Machine Portfolio

TKF 9000 (Custom)

- High pressure Cold Spray additive manufacturing and coating
- Demonstration of Titomic's ability to engineer and construct bespoke AM systems
- Build volume of 40.5m^3
- Deployed in the Titomic Melbourne Bureau

TKF 1000

- High pressure Cold Spray additive manufacturing and coating
- Designed for prototyping and low volume production tasks
- Build volume of 0.75m^3
- 1st gen system operating at Titomic Melbourne Bureau
- 2nd gen system installed at TWI (UK)

ISB Series

- Low pressure Cold Spray coating
- Robotic or linear coating system
- Automated loading and unloading of parts
- Utilises D523 core cold spray system
- Ideal for R&D deployment or as a base for customised automated coating systems

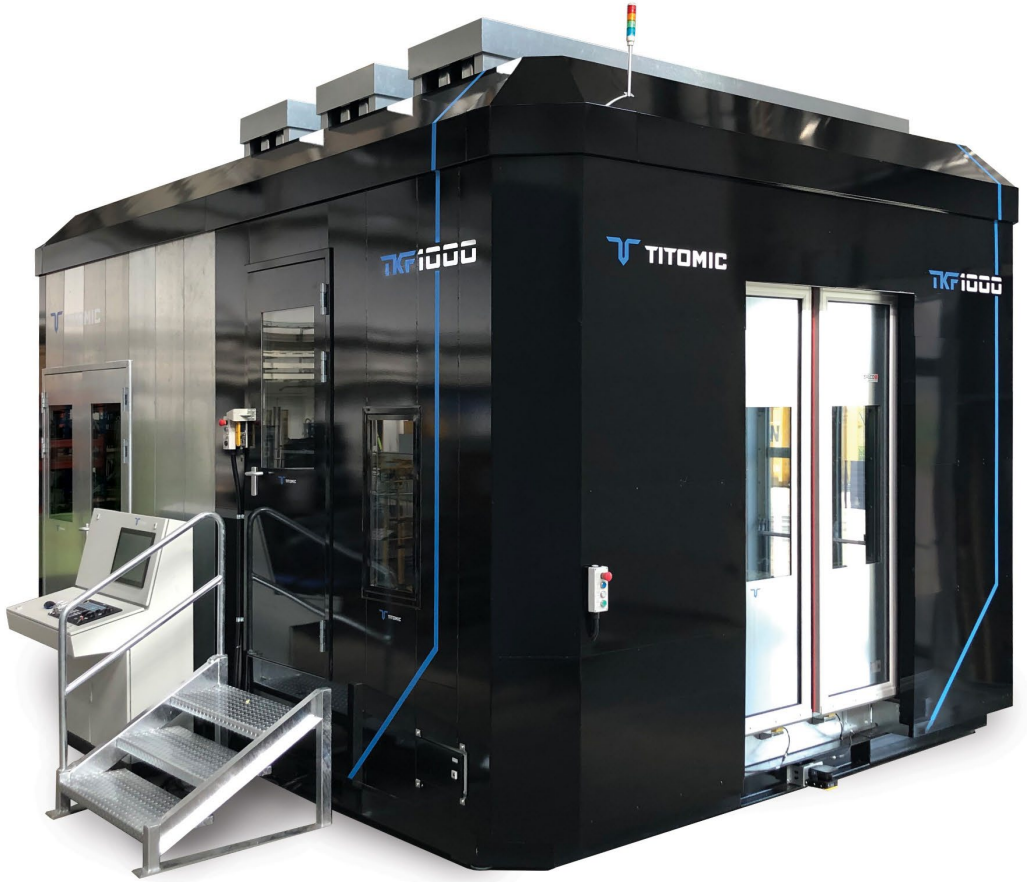
D523

- Low pressure Cold Spray coating
- Modular portable repair system
- Designed for robotic or manual repair and coatings
- Deployable for in-field repairs

Titomic TKF cold spray solutions

Maximising uptime

- Technology to the target for repair & continued operations
- Rapidly produce parts on demand
- Develop new materials: reduce in-service damage and degradation from corrosion, wear, impact damage, radiation compromise & more



Product development and focus applications

Structures

Exploiting Titomic's technology and cost benefits for lightweight, rapidly manufactured solutions

Structures

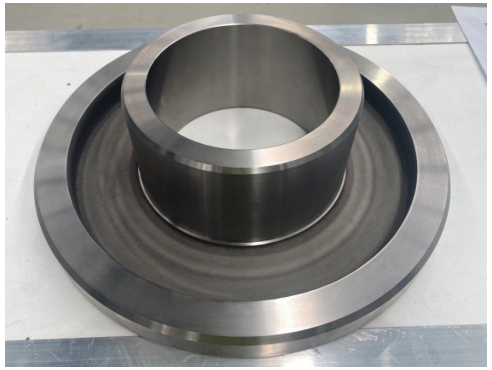
For lighter stronger titanium components

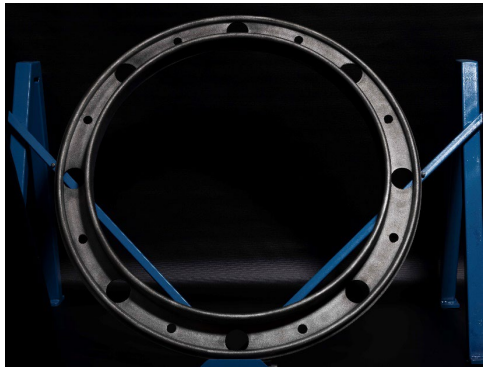
Value proposition

- Affordable titanium structures
- Near-net shape manufacturing
- Low-cost HDH titanium powder
- Melt-free manufacturing process
- Energy, emissions & environmental benefits

Applications

- Slip rings for armoured vehicles
- Tanks for satellites and rockets
- Casting replacements
- Forging replacements





Tooling

Targeting the Aerospace & Defence Industries

Tooling

Titomic enabling a simplified supply chain

Value Proposition

Offers numerous benefits for our partners and customers

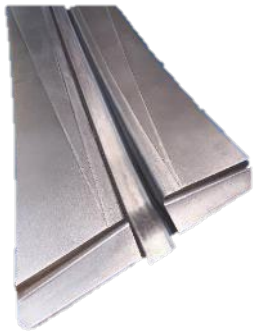
- Improved lead times
- Near net shape – Minimal post-production and machining
- TKF process makes Titanium tooling a viable option (stronger, thinner, lighter, corrosion resistant)
- Reduced welding, assembly and lead times
- Multi-material solutions, for improved heat distribution
- Ability for embedded sensors, heating and cooling

Applications

- Tool face plates for Carbon Fibre Tools
  - Aerospace
  - Automotive
- Invar 36 Face plates
- Titanium face plates
- Tool repair
  - Resurfacing
  - Geometry restoration
  - Geometry addition

Invar Face Plates

Invar Repair



Titanium Tooling

Ball Segment Valves

Exploiting Titomic's technology and cost benefits for lightweight, rapidly manufactured solutions

Titanium Ball Segment Valve

Disruptive technology for existing manufacturing methodes

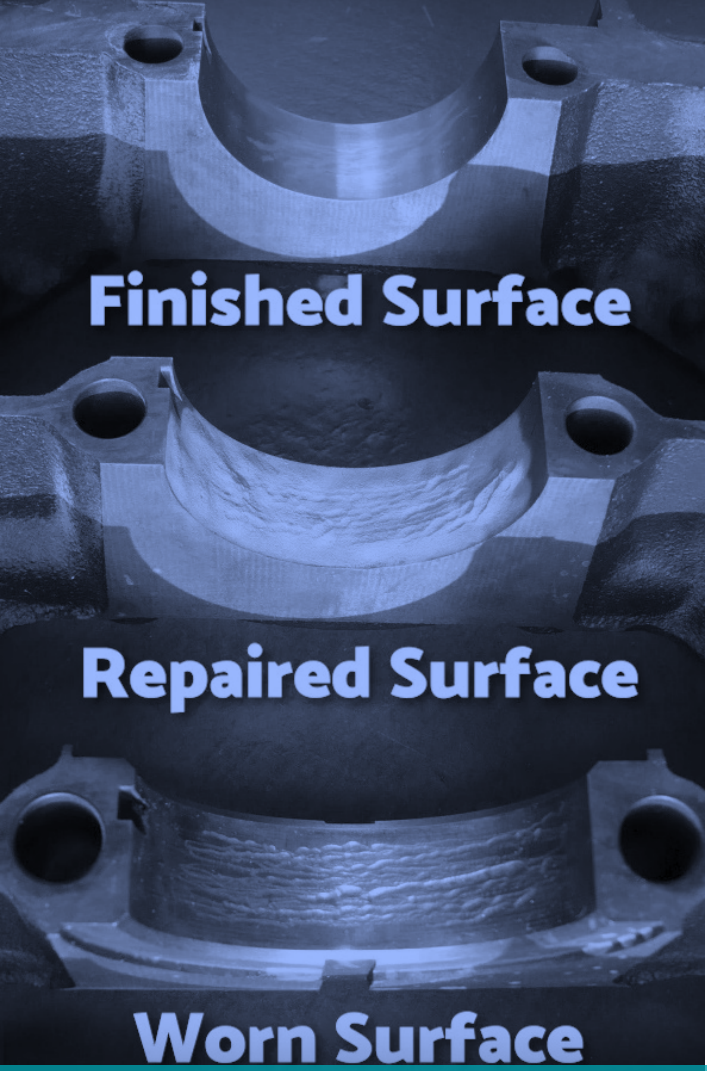
5 hr build time
Weight 27 kg

Single piece

Overspray
5%

No weld seams
No heat-affected zones

Possibility to integrate sensors



Coating and Repair

Targeting Mining, Oil & Gas, Transport and Marine Industries

Coating & Repair

Titomic extending asset life

Value Proposition

- Unique material solutions for repair
- Ability to restore geometries
- Repair in-situ
- Cold solid state repair process – no hot work
- Increase of functionality

Applications

- Oil & Gas
  - Corrosion protection
  - Geometry restoration
- Engine Re-manufacturing
- Mining

Metal Restoration

Recovering metal parts to OEM specifications

Metal Restoration

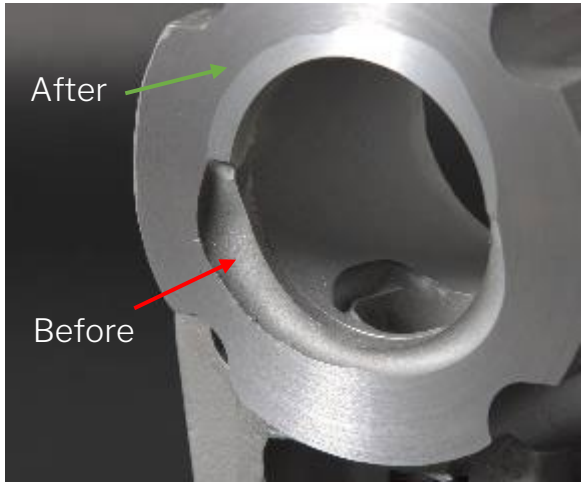
Easily repair damaged parts and surfaces to original condition without the need for welding.

Applications include

- Repair of Cast Iron/Aluminium/Steel/Copper and more
- Engine blocks and transmission casings
- Bearing seats and mating interfaces
- Electrical components and heat-exchangers
- Pitting, porosity or cracking
- Hermetic sealing of leaks

Benefits

- No heat effected zones
- No pre-heating of part
- Repairs up to 50mm thick
- no robotic programming required
- Directly machinable
- Fast and portable
- Doesn’t require dry or clean surfaces



Use Case – Metal Restoration

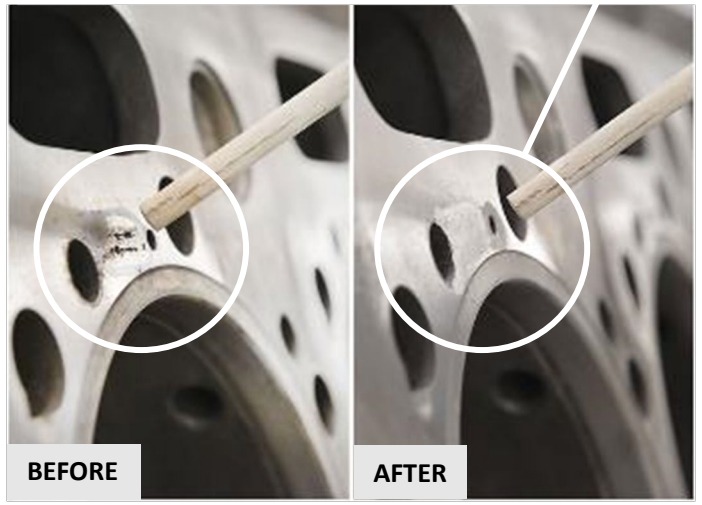
MTU GmbH

A Rolls-Royce solution

- Adopted cold-spray in 2011
- Significantly faster and stronger repairs
- An established part of the engine remanufacturing process
- In Magdeburg alone, over 60 crankcases are repaired per year with CS.
- One crank case can be upwards of USD $300K, and 6 months lead time

"We can offer customers quick and high-quality reconditioning of parts, the speed with which the component is ready for use again is unbeatable"

MTU Reman Technologies Magdeburg.



'It can fill surface damage up to 10 mm deep within a few minutes. And the best thing is, the crankcase itself is hardly heated at all, does not have to dry out and can be further processed immediately afterward. As well as that, the repair lasts significantly longer."

MTU Reman Technologies Magdeburg.

Images and quotes courtesy of MTU Reman Technologies Magdeburg

Use Case – Metal Restoration

Composite Materials Engineering

COMPOSITE MATERIALS ENGINEERING PTY LTD

$2,850 vs $38,000

4 hours vs 3 months.

- 4-Tonne Steel tool working surface damaged during operation
- Required urgent repair, holding up production
- CME quoted $38K + 3-4 months turnaround via international
- Titomic took the D523 to site, repair conducted in 4 hours and cost $2,850.
- Tool was finished manually and has since produced over 400+ shower floors.


DAMAGED


AFTER REPAIR (not polished)

Use Case – Metal Restoration/Coating

D&C Coating Singapore

- Using cold spray since 2015
- One of the main reman workshops in APAC
- Repairs over 200+ cast iron and bronze parts per year with CS
- Saves 100's of man-hours vs welding per year, and tons of scrap.
- D523 offers far superior repairs to other forms of thermal spray

Functional Coatings

Extend and protect the life of valuable assets

Functional Coatings

Apply a large variety of functional metal coatings to protect components in harsh operating environments.

Applications include

- Corrosion resistant coatings
- Heat resistant coatings
- Electrically conductive coatings
- Anti-fouling/bacterial coatings

Benefits

- No heat
- Much thicker coatings
- No size limitations
- Coatings applied on site

Silver on Copper Bus Bar
– electro-plating replacement

Radiation Shielding

Targeting the space industry

Radiation Shielding

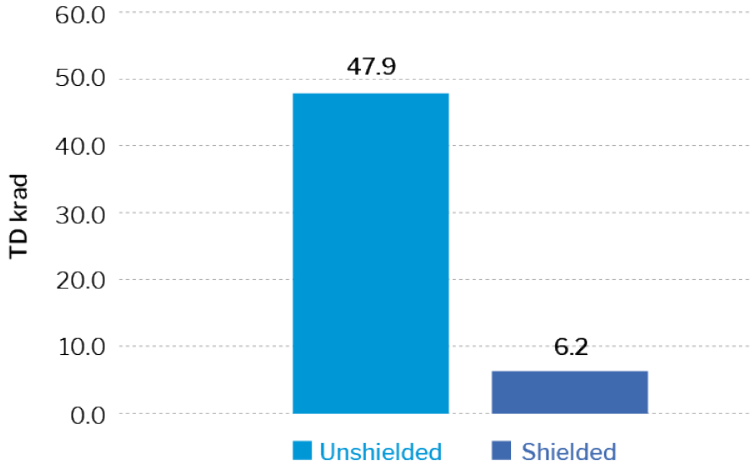
Titomic creating tailored, cost-effective shielding

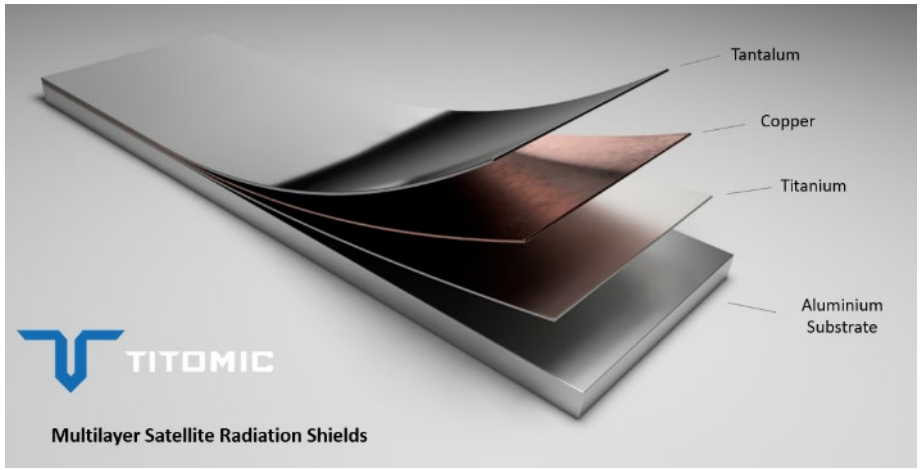
Value Proposition

- Extending life of satellites
- Mission specific tailored designs
- Weight efficient shielding
- Cost-effective

Applications

- Applications across a broad range of satellite platforms
  - Lightweighting
  - Mission extension
- Medical devices



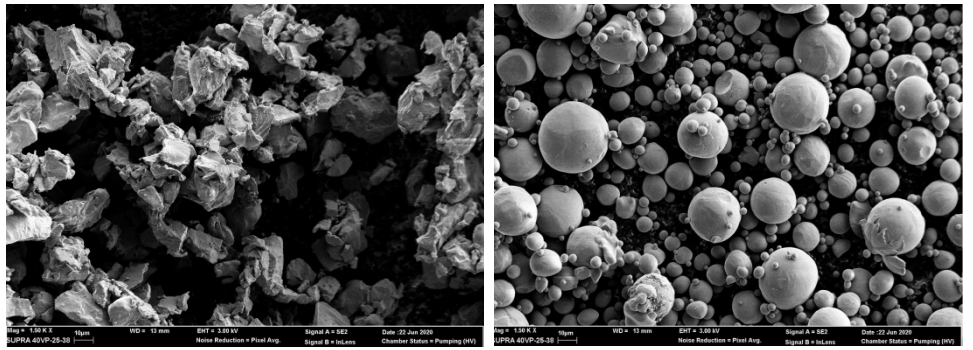


Unique powder supply for lower cost titanium

Cost effective and clean

Our TKF process can use hydride-dehydride (HDH) titanium powders to cut the cost and boost the performance of titanium parts.

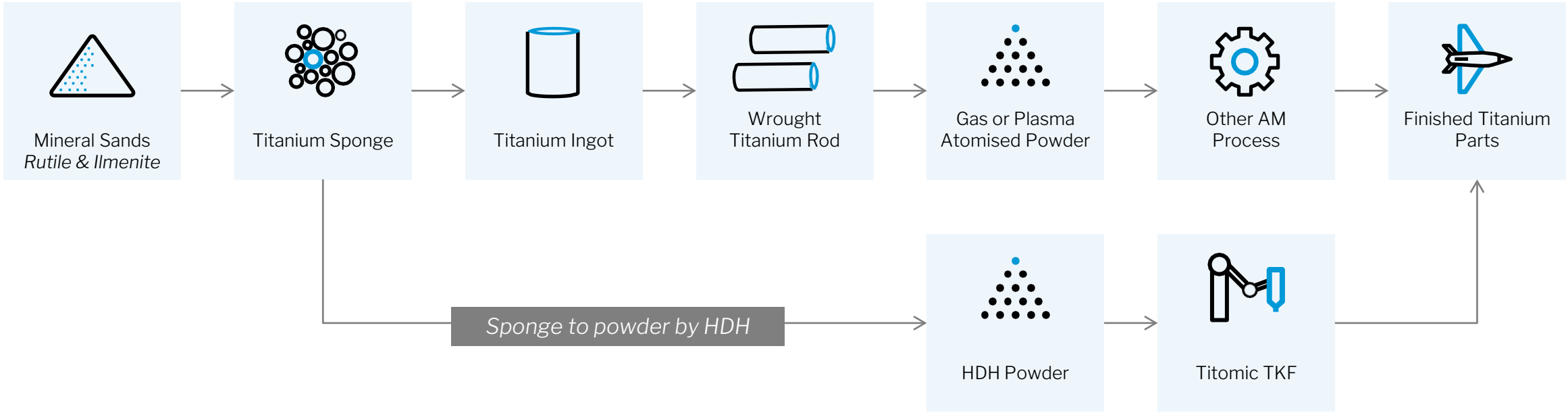
This clean hydrogen technology has low carbon emissions as compared to gas atomised powders and wrought titanium products.



SEM micrographs

Right: Spherical titanium powder

Left: Irregularly shaped HDH titanium powder



Mechanical properties

Cold Spray AM CP-Titanium

Typical Properties of TKF Cold Spray Titanium[2]

Mechanical properties[3]	TKF CSAM (Recipe 1)	TKF CSAM (Recipe 2)	TKF CSAM (Recipe 3)
Ultimate Tensile Strength (UTS)	863 MPa (125 ksi)	727 MPa (105 ksi)	784 MPa (114 ksi)
Yield Tensile Strength (YTS)	817 MPa (114 ksi)	619 MPa (90 ksi)	708 MPa (103 ksi)
Elongation at Break (%)	3.0	10.0	14.0
Post Processing	Heat Treated	Heat Treated	Heat Treated + HIP
Density	>99.5%		

Chemical Composition of TKF Cold Spray parts[1]

Chemical Elements, Nominal Composition (wt. %)							
Material	**Ti**	**C**	**H**	**O**	**N**	**Fe**	**Residual max ea.**
TYP. CSAM CP-Ti	Bal.	≤0.03	<0.005	≤0.6	<0.15	0.01	<0.1
- Recipe 1	Bal.	0.02	0.002	0.5	0.13	0.01	<0.1
- Recipe 2, 3	Bal.	0.02	0.002	0.48	0.033	0.01	<0.1

[1] Various grades and/or chemical compositions of TKF CP-Ti parts can be tailored. Contact Titomic for further information

[2] Rotationally fabricated coupon stock produced on Titomic TKF1000 system

[3] ASTM E8 Standard Test Methods for Tension Testing of Metallic Materials

Properties controlled using material feedstock, build parameters, post-processing

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