An inside look at the making of TruForm™ metal powders for AM
Design for the future. We’ll help you make it.

TruForm™ metal powders are the only AM metal powders from Praxair, the leader in high-performance industrial powders for more than 50 years.

Our specialized manufacturing process is engineered on the ability to deliver:

> **Large-scale Capacity**

Proprietary process provides:
- Higher yields
- Consistency
- Higher purity
- Faster delivery

> **Aerospace-grade Quality**

Praxair has been producing aerospace grade metal powders for more than 40 years.

> **Backed by decades of Expertise**

The TruForm™ Advance Team, including in-house engineers, scientists and technicians, continuously improves the formulation, production and printing of metal powders.

Customers appreciate the level of customization Praxair can provide. That can include improvements in size distribution and improvements in chemistry. We can adjust an existing alloy or develop a whole new alloy.

— Bill Jarosinski
Director, R&D Materials
Praxair Surface Technologies
TruForm™ manufacturing process:

Nobody does it like Praxair. We’ve combined our decades of metal powder experience with our AM industry know-how to provide you a proven manufacturing process. The result is aerospace-grade powders for superior part performance.

**STEP 1**

**Tru2Spec™ Product Design**

Complete powder validation before you purchase

For every TruForm™ metal powder order, regardless of batch size, Praxair provides a complete analysis of your requested formula, including:

- Chemistry profile
- Flowability measures
- Particle sizing
- Morphology

**STEP 2**

**Batch**

Formula flexibility at any production scale

Our AM metal powder formulas begin with elemental raw materials or ingots. By creating TruForm metal powders from aerospace-grade elemental raw materials, we’re able to quickly create and formulate custom alloys of any production scale, while maintaining high purity.

**Batch capabilities:**

- Wide range of in-stock raw materials
- Thousands of powder formula combinations
- Lot sizes from 5 kg to 2,500 kg

**STEP 3**

**Melt & Pour**

Decades of consistent chemistry results

The melt and pour process is engineered by members of the TruForm Advance Team with decades of expertise in metallurgy and atomization. This lets us fine-tune pour rate and temperature to ensure particles will meet shape and size specifications and rapidly adapt our processes for the high level of customization in metal AM.

**Operational Excellence**

All Praxair TruForm metal powders are produced under our Operational Excellence Program, which combines key principles from proven continuous improvement programs (such as Six Sigma and Lean Manufacturing).

Our exclusive six-step scorecard grades every TruForm metal powders order for timing, safety, productivity, quality, continuous improvement and customer satisfaction.
Collect & Size
Uniform powder size and shape for repeatable part production

After atomization, TruForm powders are sized to guarantee particles fall within your application’s spec. Our sieve and air classifying systems are capable of sorting particles from 1-250 microns, allowing us to meet the specific requirements of all AM technologies.

It’s Tru:
Proven in aviation
It’s estimated that more than 1 million pounds of our powder is in the air at all times.

Atomize
Higher yield delivers higher capacity and purity

We produce TruForm™ metal powders using state-of-the-art close-coupled gas atomizers, which yields more powder per batch than legacy technologies like free-fall gas atomization and EIGA (electrode induction melting gas atomization). We have small and large close-coupled gas atomizers able to produce lot sizes from 5 kg to 2,500 kg to satisfy your prototyping to production powder needs.

Blend
Homogeneous particle size distribution enables optimal packing density

The blending process ensures every package of your TruForm powder formula has consistent particle size and shape distribution to enable repeatable part production.
Inspect for Quality

Nadcap-certified inspection to ensure powder performance and quality

Before packing and shipping, every TruForm metal powder order undergoes a quality control review in our dedicated, aerospace-certified metal powder QC lab. At the end of each QC testing process, a TruForm Advance Team member reviews and signs off on the results.

The inspection process includes:

- **Full chemistry analysis** ensures the produced powder meets your specification requirements.
- **Particle size distribution analysis** ensures every powder lot is sized for your application.
- **Flow analysis** ensures batch consistency and optimal flowability for your AM process.
- **Density testing** ensures low porosity powder is delivered for optimal part performance.

Package

Preventing contamination and enabling fast shipment

Attention to quality and detail continue in the last step of the TruForm metal powders production process with our in-house packaging to reduce the risk of introducing contaminants and moisture to finished powders and facilitates on-time, on-demand delivery.
Printing in-house on multiple additive technologies allows us to better understand the challenges our customers face and provide solutions for improved performance. This may include a custom TruForm powder for better properties or a new parameter set to help our customers move from prototyping to production.

— Andy Shives
Business Manager, 
Additive Manufacturing
Praxair Surface Technologies

TruForm™ Center for AM Advancement

In our in-house TruForm™ Center for AM Advancement, the TruForm Advance Team is continually innovating, researching and developing new powder formulas, solutions and properties to stay ahead of AM trends. Our center is used for customer powder formula prototyping, internal part production, as well as our own AM R&D. The TruForm AM testing lab supports powder performance testing for major metal AM processes. We continually invest in the newest AM printing innovations to ensure our powders seamlessly integrate into your printing processes.

TruForm™ Center for AM Advancement features:

Custom powder prototyping
No batch size is too small. The TruForm Advance Team develops powders in lots as small as 5 kg to support your product testing.

Internal part production
With in-house AM printing capabilities, we can create prototype parts to test powder performance in both the finished product and production process.

Testing for major AM metal processes
The TruForm Center for AM Advancement supports multiple additive technologies. We are continually investing in the latest technologies for the center to stay ahead of industry process trends.

Internal AM R&D
In the TruForm Center for AM Advancement, the TruForm Advance Team tests and refines their latest innovations in AM metal powders, working to proactively develop solutions for the future of metal AM.

It’s Tru:

Continuous innovation
Praxair is home to the world’s only production close-coupled titanium atomizer. Our TruForm Advance Team is continually formulating new chemistries to help our customers achieve desired mechanical properties and fatigue ratings.
Certified

Manufacture and Distribution of Industrial Consumables: ISO 9001:2015 and AS9100D
Praxair Surface Technologies
A history of excellence in metal powders

- **1961:** Developed first powders at Union Carbide Speedway, IN operations
- **1977:** Praxair introduces ceramic powder manufacturing
- **1994:** Earns first AS9100 certification
- **2014:** Additive Manufacturing powder division created
- **2015:** TruForm™ Center for AM Advancement opens and prints parts
- **2019–** Continuous development in products, quality and powder manufacturing lead metal AM into the future

- **1975:** New powder plant with first vacuum melt gas atomizer
- **1988:** Expansion including two vacuum induction gas atomizers
- **2000:** Expansion doubling atomization capacity supporting powder growth
- **2015:** World’s first production close-coupled atomizer for titanium goes into operation
- **2017:** Over 5 million pounds of metal atomized in single year
TruForm™ metal powders are forming the future of AM with:

**Capacity**
- Lot sizes from 5 kg to 2,500 kg
- High-purity elemental raw materials, in-stock:
  - Co, Cu, Fe, Ni, Ti
- World’s first and only close-coupled atomizer for titanium powder production

**Quality**
- Dedicated, on-site quality control lab
- Aerospace certification since 1986
- In-house TruForm™ Center for AM Advancement

**Expertise**
- Dedicated TruForm Advance Team
- Expertise in metallurgy, chemistry, manufacturing and quality control
- Serving leading OEMs across AM industry

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About Praxair Surface Technologies

Praxair Surface Technologies makes more possible with 2,500 engineers, technologists and metal powder experts across more than 35 sites in 12 countries. Our commitment to more innovative processes, equipment and technology expands AM production capabilities, extends the life of critical components and keeps industries running efficiently.

praxairsurfacetechnologies.com/am

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Start making your AM metal future with proven powders from Praxair

Learn more at praxairsurfacetechnologies.com/am or contact the TruForm Advance Team:

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