continuum

2025 Continuum Powders

eBook

Recycled Metal in Aerospace: Technical Considerations for Powder Production

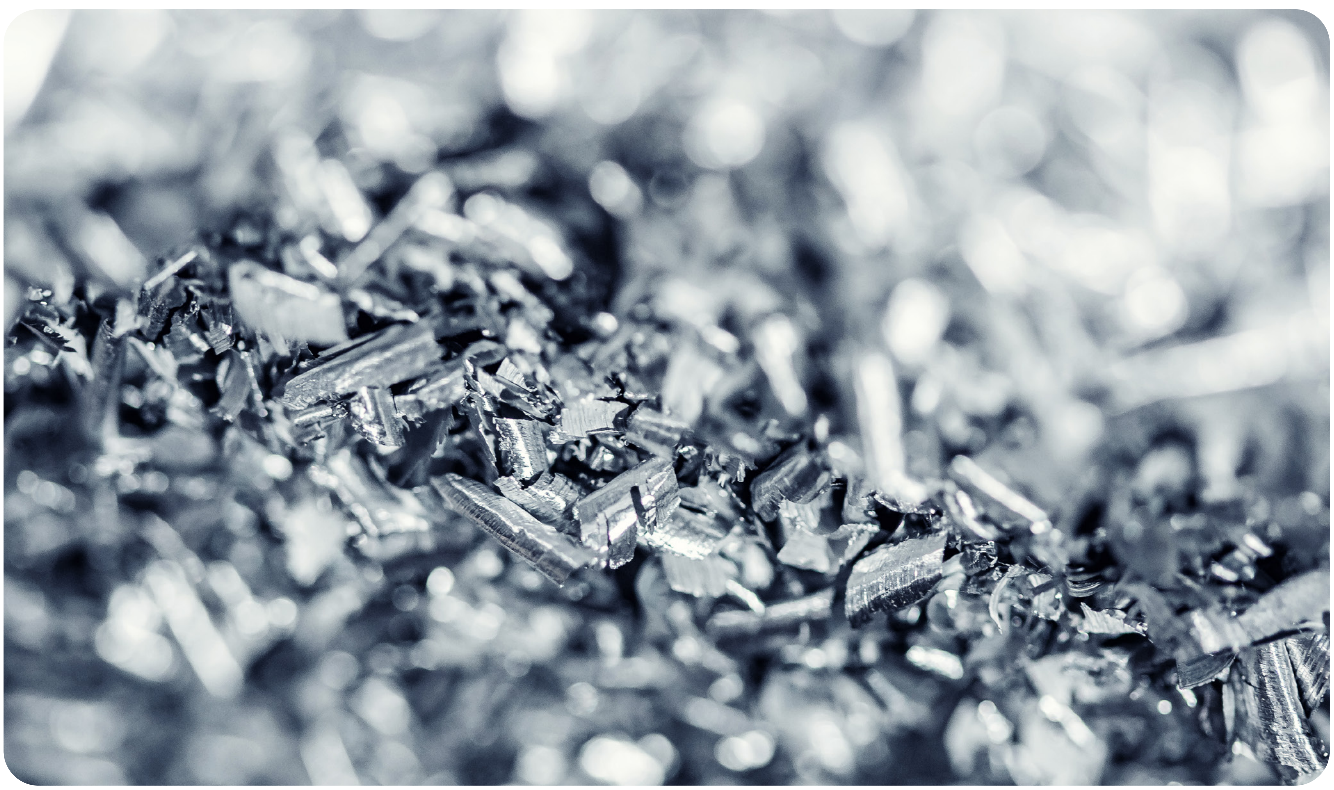
How Continuum Powders Delivers Certified Scrap-to-Powder Solutions for Critical Aerospace and Defense Applications.

The Materials Pressure in Aerospace

- Global supply chain fragility for aerospace-grade superalloys (Ni718, Ti64, M247, etc.)
- Geopolitical instability, mining constraints, and energy costs drive raw material price volatility.
- Expanding demand for high-performance alloys in additive manufacturing.
- Sustainability mandates: Scope 3 emissions, material circularity, and decarbonization targets.

The Challenge to Overcome:

Aerospace already incorporates reclaimed metals on a large scale. The challenge lies in extending proven recycling principles to new alloys and new feedstock forms like gas atomized powder, where process control is crucial.



Aerospace Is Already Reclaiming Metal at Scale

Boeing & Alcoa Closed-Loop Program

- Reclaims over 8 million pounds per year of 2XXX and 7XXX aluminum alloy scrap.
- Remelted, recertified, and reintroduced into aerospace-grade billet stock.
- Maintains full traceability and mechanical property assurance.

Source[1]

Rolls-Royce Revert Program

- Processes over 95% of engine manufacturing waste and retired parts.
- Reclaimed nickel, titanium, and cobalt-based superalloys.
- Full metallurgical traceability into new certified engine components.
- Supports both ESG targets and cost control of raw materials.

Source[2]

Conclusion:

Reclaimed alloys are already operating in the highest-risk aerospace systems. The issue is no longer feasibility; it's precision control.

[1] Boeing and Alcoa Form 'Closed-Loop' Program To Boost Recycling of Aluminum Aerospace Alloys | Howmet

[2] Rolls-Royce Revert

The Unique Requirements of Powder-Based AM

Powder metallurgy introduces additional sensitivities beyond ingot or billet-based metallurgy:

VARIABLE	RISK	IMPACT
Chemistry variation	Scrap misclassification, melt loss	Composition drift outside AMS/ASTM specs
Oxygen pickup	Excessive remelt cycles, oxidation	Reduced ductility, fatigue resistance
Inclusion contamination	Heavy particle carryover, tool wear debris	Porosity initiation, crack propagation
PSD & morphology	Irregular atomization	Flowability degradation, density defects

Even minor compositional drift or morphological variation can compromise the mechanical properties of AM parts.

Defining "Recycled" for Additive Manufacturing

Conventional powder reuse ≠ true alloy recycling:

Powder reuse:

- Post-build sieving of unused AM powder
- Debris inclusion risk (spatter, condensates)
- Chemistry unchanged, but contamination accumulates
- Changes in powder particle size distribution and properties

Continuum's scrap-to-powder model:

- Scrap certified to the original AMS/ASTM alloy specifications
- Flexible scrap form compatibility, including solids, powders, chips, turnings, etc.
- Full remelting and atomization into a new powder
- Virgin-equivalent chemistry and powder quality
- Inclusion management via cold hearth refining

Continuum's Process Controls:
Scrap to Spec

1

Feedstock Qualification

- Certified turnings, solids, oversized powder, and retired components
- Traceable to source heat certification
- Alloy class verification (e.g., Ni718, M247, Ti64, etc.)

2

Feedstock Qualification

- Mechanical cleaning (e.g., tumbling, shot blasting)
- Chemical cleaning (e.g., solvent degreasing, acid etch)
- Alloy sorting & chemical assay validation (ICP-OES, XRF, GDMS)
- Heavy metal impurity screening

3

Melt-to-Powder Atomization (Greyhound M2P)

- Plasma melting in controlled atmosphere
- Cold hearth refining — molten pool allows dense inclusions to settle
- Direct gas atomization yields highly spherical particles
- Single-step melt minimizes oxidation risk

4

Post-Processing & QA

- Sieving for PSD control
- Flowability testing
- Apparent density and tap density verification
- Chemistry confirmation (ASTM E1473, E2991 standards)
- Inclusion analysis via SEM/metallography
- Batch traceability documentation

Performance Validation: Virgin-Equivalent Output

Technical Outputs:

- PSDs: Customized PSD ranges for multiple applications
- Flowability: Consistent with virgin powders (Hall flow, Carney flow)
- Oxygen levels: Controlled to standard AMS/ASTM limits
- Chemistry: Verified against target AMS specifications for relevant alloys
- Inclusion levels: Reduced by cold hearth refining

Mechanical Property Performance:

- Tensile strength, elongation, fatigue, and creep meet design allowable targets.

Powder produced from qualified reclaimed feedstock performs equivalently to virgin raw material when processed under Continuum's controlled system.

Added Benefits: Economics & Sustainability

ADVANTAGE	VALUE
Raw material cost reduction	Eliminates virgin ore dependency
Pricing predictability	Insulated from geopolitical commodity swings
Supply chain resilience	Domestic scrap sourcing reduces global logistics risk
ESG alignment	Up to 99.7% CO_2 emissions reduction (OSU LCA study)
Qualification support	Batch documentation and full QA traceability

Conclusion:
Precision-Controlled Circularity

Through chemistry-controlled, inclusion-managed, and process-validated scrap-to-powder production, Continuum Powders enables:

- Lower powder procurement costs
- Stable long-term supply contracts
- Certified traceability with aerospace QA processes
- Significant reductions in environmental impact

Recycled alloys are already flying. The next step is applying advanced process control to deliver certified powders for additive manufacturing.

Technical Inquiries & Qualification Support

Request a technical consultation, powder sample evaluation, or detailed data package:
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