Fabrication Technologies

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Fabrication Technologies Overview

Ultimate Goal: To go from Lunar Regolith to Fabricated Part

Fabrication technology will be a key area to enhance self-sufficiency on the Moon.

The ISFR team at MSFC studied the options and the requirements for a fabrication capability and selected Electron Beam Melting (EBM), as the best candidate for a wide range of potential lunar applications and parts, utilizing a range of metals.

The Electron Beam Melting machine

This technology uses an electron beam in a vacuum to melt metal powders layer-by-layer. The build results in a near-net shape part that is fully dense. In other words, the part does not have the voids and pits found in similar powder-based additive manufacturing processes. Mechanical testing of titanium samples has shown good strength properties as well as fracture and fatigue. Results show the properties exceed those of similar cast materials and are comparable to wrought values. This is very promising data and validates the decision to concentrate on the EBM process.

Technology Highlights

- Completed parts can be delivered in 24-48 hours
- Ability to fabricate complicated geometries
- Lattice structures for weight savings and unique applications
- One-piece assemblies reduce part count
- Material properties comparable to typical aerospace grade values
- No tooling required as needed for traditional methods
- Parts built in vacuum, resulting in a clean build environment
- Electron beam melting process produces full-density material

EBM Process

- CAD model is used to define geometry
- CAD model converted to a build file defining multiple layers
- Machine establishes vacuum and powder bed is preheated
- Using specific process parameters, part is built layer-by-layer
- Rake system provides a smooth layer of powder
- Electron beam melts the geometry for that specific layer
- Platen lowers and rake supplies a new layer of powder
- Powder bed is allowed to cool, and part is removed (vacuum released)
- Part is cleaned in blast cabinet

Learn more information about this process on the Arcam Website.

EBM Processing Benefits

Ability to Fabricate Unique and Complex Geometries

Ability to Reduce a Multi-Part Assembly Down to a Single Part

- Lattice and honeycomb structures
- Compound curvatures
- Integral passages and cavities
- Varying height fins within spiral grooves
- Custom-fitted medical implant

- Reduces part count
- Reduces weight
- Reduces assembly time
- Less material waste

Provides Greater Design Flexibility

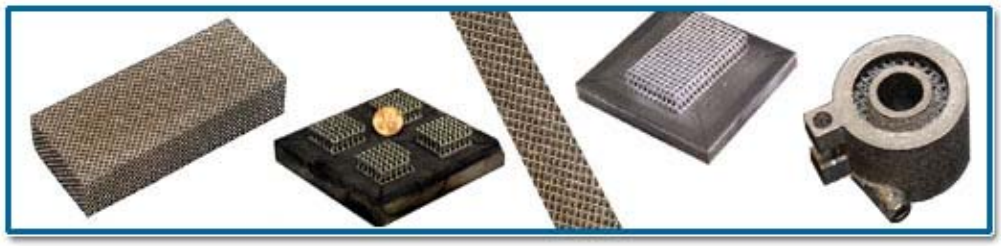
- Ability to build components unachievable with Traditional manufacturing methods
  - Internal passages can be fabricated
  - Lattice structures incorporated into otherwise solid parts

No Tooling Required for Near Net Shape Fabrication

- Significant time savings over traditional methods
  - EBM processing uses powder bed as support
  - Traditional methods require fabrication of tooling
- Secondary finishing still required for improved surface finish, threads, and coatings

The Parts

Internal Lattice Structures



Complex Geometries

Medical Industry Parts

For more information, please contact:

Project Manager: Carole McLemore
(256) 544-2314
Carole.A.McLemore@nasa.gov