

Electron
Beam
Melting

The Future is Here!

Titanium or Cobalt Chromium Alloy Parts

CAD directly to METAL Free Form Fabrication

Your organic or optimized design is NOT CONSTRAINED by conventional techniques!

- Direct Manufacturing
- Fully-Functional Prototyping
- Complex Geometries
- Costs comparable to castings
- Material performance comparable to CNC billet
- Speeds as high as 1.6" per hour
- Build envelope of 8" x 8" x 7"

Aerospace
8 hrs.

Optimized
Engine Bracket
8.5 hrs

Biomedical

Race Car Suspension
6 parts in 4.5 hrs.

Turbo Machinery



www.rapidtitanium.com

Direct Manufacturing



Drillbit for Oil Exploration

Functional Prototypes



Turbine Blade

Race Car Suspensions



Performance Pistons



Lightweight Designs



Lattice Structure

Biomedical Products



Human Knee Implants

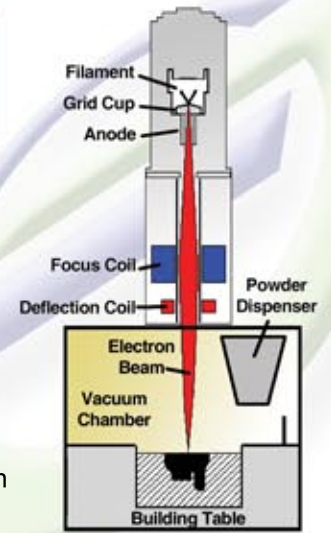
EBM - Electron Beam Melting Applications with Ti6Al4V or ASTM F75

Arcam EBM®



The technology:

- Electrons are emitted from a filament, which is heated to > 2500° C
- The electrons are accelerated through the anode to half the speed of light
- A magnetic field lens brings the beam into focus
- Another magnetic field controls the deflection of beam
- When the electrons hit the powder, kinetic energy is transformed to heat.



Retained chemical composition due to:

- Good vacuum at less than 10⁻⁴ mbar
- Very small melt volume
- Rapid cooling from liquid to solid state
- Continuous stirring in the meltpool

The material from the EBM process:

- Naturally aged condition
- Fully melted
- Vacuum melt quality eliminates impurities
- Microstructure similar or better than cast
- Controlled grain size
- Monitored thermal environment.
 - Good form stability.
 - Low residual stress in part
 - Consistency
- High yield strength properties



100% Density

100 µm

Ti6Al4V Alloy	EBM	Spec.
Aluminum, Al	5.7%	5.5-6.5%
Vanadium, V	3.9%	3.5-4.5%
Iron, Fe	0.1%	<0.3%
Oxygen, O	0.1%	<0.2%
Nitrogen, N	0.03%	<0.05%
Hydrogen, H	<0.0005%	<0.01%

ASTM F75 Alloy	EBM	Spec.
Chromium, Cr	28.5%	27-30%
Molybdenum, Mo	6%	5-7%
Carbon, C	0.3%	Max 0.35%
Iron, Fe	0.2%	Max 0.75%
Nickel, Ni	0.25%	0.5%
Manganese, Mn	0.5%	Max 1%
Silicon, Si	0.7%	Max 1%
Nitrogen, N	0.15%	Max 0.25%

	Ti6Al4V	ASTM F75
Yield strength (Rp 0.2)	910-960 MPa	600 MPa
Ultimate Tensile strength (Rm)	970-1030 MPa	900 MPa
Rockwell hardness	30-35 HRc	34 HRC
Elongation	12-16 %	10%
Fatigue strength@500-540 MPa ~After Hot Isostatic Pressing	>1.3 million cycles	



www.rapidtitanium.com

25335 Interchange Ct., Farmington Hills, MI 48335

313-215-3076 Fax: 206-309-0758

project@rapidtitanium.com