GADS VITALLIUM

UNS R31539

Applicable specifications: ASTM F1537, Grade 3.
Note: While this material meets the above specifications, it may be capable of meeting or being manufactured to meet other general and customer-specific specifications.

Type analysis

Single figures are nominal except where noted.

Cobalt	Balance	**Chromium**	26.0–30.0 %	**Molybdenum**	5.00–7.00 %
Aluminum	0.30–1.00 %	**Manganese**	1.00 %	**Silicon**	1.00 %
Iron	0.75 %	**Nitrogen**	0.25 %	**Lanthanum**	0.03–0.20 %
Nickel	0.20 %*	**Carbon**	0.14 %		

**Denotes tighter than industry standards*

Forms manufactured

Bar-Rounds	larger than 0.250 in.

Description

GADS Vitallium is a non-magnetic, cobalt-chromium-molybdenum alloy possessing a unique combination of high strength, excellent corrosion resistance, high wear resistance, and improved fatigue strength over its counterparts R31537 and R31538.

This alloy is a dispersion-strengthed variant of BioDur CCM, manufactured as a wrought powder metallurgy product. It is produced by vacuum induction melting (VIM) followed by gas atomization and hot isostatic pressing to produce 100% dense billets. These billets are then processed by conventional steel-making practices to produce finished products.

Key Properties:

- High fatigue strength
- Excellent corrosion resistance
- Superior wear resistance

Markets:

- Medical, implant materials
- Medical, orthopedics

Applications:

- Medical implants requiring high fatigue strength and excellent wear resistance, such as femoral inserts, spinal rods, and other joint reconstruction components

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Product attributes

- Extremely good cleanliness (low inclusion content)
- Homogenous chemistry and microstructure
- Small, uniformly distributed lanthanides acting to retain strength through high temperature exposures, such as forging and annealing
- Small, uniformly distributed carbides, typically less than 10 microns in length
- Ultra fine grain austenitic structure, typical of a material born from a wrought-power process
- Improved forgeability over BioDur CCM
- Retains a high strength level after high temperature annealing
- Improved machinability over BioDur CCM and CCM+

Bio-compatibility summary

GADS Vitallium has been deployed for various implant applications in contact with both soft tissue and bone. Precedence of acceptability within the medical market has been established, and biocompatibility reports on the alloy are available within the medical community.

Properties

DENSITY	0.302 lb/in^3
MAGNETIC PROPERTIES	This material is non-magnetic in all supplied conditions.
FATIGUE STRENGTH	This alloy can obtain a fatigue strength greater than 100 cycles (rotating ream) of 70-95 ksi.

Typical mechanical properties

ROOM TEMPERATURE MECHANICAL PROPERTIES[1]

FORM	ORIENTATION	0.2% YIELD STRENGTH $\sigma_{0.2\%}$		ULTIMATE TENSILE STRENGTH σ_{UTS}		ELONGATION IN 4D	REDUCTION OF AREA	HRC
		ksi	MPa	ksi	MPa	%	%	
Annealed	Long.	145	1000	185	1276	10	10	41

[1] *Tested at ~1.00 in. bar. Low stress grinding on all types of CCM alloy test samples is suggested.*

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Heat treatment

Annealing	GADS Vitallium can be annealed at 2000°F/2100°F (1093°C/1149°C) for 2 hours followed by air cooling. Finer grain size can be maintained through the use of lower annealing temperatures with corresponding increases in annealed hardness.

Workability

Hot working	GADS Vitallium alloy should be hot worked from a furnace temperature of 2050/2100°F (1121/1149°C).
Cold working	Similar to BioDur CCM, high strength levels can be achieved in GADS Vitallium through either hot/cold work or cold work only processes. Significant loss of ductility results from even small amounts of cold work.
Machinability	Similar to BioDur CCM, GADS Vitallium is difficult to machine in any heat treated condition due to its extremely high work hardening rate, low thermal conductivity, and the presence of hard, abrasive carbides and intermetallics in the microstructure. Tool geometry, rigidity, and adequate machine power are all extremely important considerations.

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Corrosion resistance

GADS Vitallium exhibits excellent resistance to implantation environments, as demonstrated by its use in medical implants for decades.

IMPORTANT NOTE:
The following 4-level rating scale is intended for comparative purposes only. Corrosion testing is recommended; factors that affect corrosion resistance include temperature, concentration, pH, impurities, aeration, velocity, crevices, deposits, metallurgical condition, stress, surface finish, and dissimilar metal contact.

Nitric Acid	Excellent	**Sulfuric Acid**	Good
Phosphoric Acid	Good	**Acetic Acid**	Excellent
Sodium Hydroxide	Moderate	**Salt Spray (NaCl)**	Excellent
Sea Water	Good	**Sour Oil/Gas**	Excellent
Humidity	Excellent		

For additional information, please contact your nearest sales office:
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