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Cobalt Chromium in Biomedical Applications and the development of a PSPP map

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BIOMEDICAL IMPLANTS

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COBALT-CHROMIUM

Champion of metallic materials, made of 70% Co and 30% Cr. Along with additional elements like Molybdenum, Tungsten and Nickel.

Diving into the processing techniques, microstructure, mechanical properties of the material will help in the development of its PSPP (Process-Structure-Properties-Performance) map that is considered the main goal of this project.

APPLICATIONS

- Gas turbines.
- Orthopedics Implants.
- Dental implants.
- Aircraft & automotive components.

Composition

Element	ASTM F75
Co	58.9-69.5
Cr	27-30
Mo	5-7
Ni	2.5
Mn	1.0
Si/Ti	1.0/0.10
Fe/C	0.75/0.35

BIOMEDICAL USE?

- ASTM F75 is the most used for medical implants.
- High strength.
- Excellent wear and corrosion resistance especially in Chloride conditions.
- Biocompatibility.
- Low friction & Low coefficient of friction.
- Flexibility in Design.
- 300% higher resistance than Titanium.
- Biostability

PROCESSING

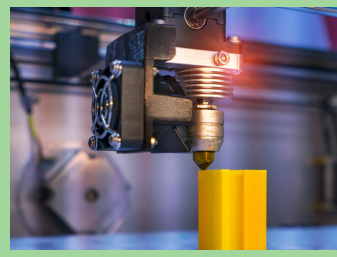
The raw material is meticulously selected and undergoes controlled melting, shaping, and surface treatments to meet stringent biocompatibility and quality standards. This process ensures the production of safe and durable components for use in various biomedical implants, including orthopedic and dental applications.

CASTING



When F75 is formed by investment casting, the alloy is heated to a high temperature (1350°C-1400°C) and melted, then poured or pressured into ceramic molds to be cooled and solidified to meet the appropriate shape to be used for biomedical applications.

ADDITIVE MANUFACTURING



A manufacturing process that builds objects layer by layer. The fundamental idea behind this technology is the layering of real product manufacture with CAD software. Good examples of AM would be EBM-Electron Beam Melting and SLM-Selective Laser Manufacturing.

POWDER METALLURGY



Powder metallurgy is a manufacturing process that involves forming solid objects from metal powders. The process typically consists of powder production, blending, compaction, sintering and quality control.

CO-CR



PERFORMANCE

The performance of Co-Cr in biomedical implants is crucial for several reasons. The patient's well being coming first, their biocompatibility and longevity, to ensure no allergic responses and a long term use. Their wear and corrosion resistance in the presence of bodily fluids. The material has to exhibit excellent properties such as strength, stiffness and hardness.

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