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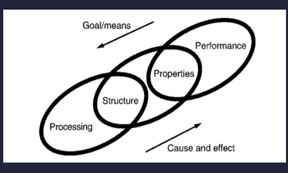
Design of Process-Structure-Property-Performance Road Map of Titanium Alloy Constructed using additive Manufacturing

othmane omalek
Mississippi State University, oo163@msstate.edu

anas rochdi
Mississippi State University, ra1069@msstate.edu

PSPP Infographic

The goal of this project is to adapt data of a selected material into a Process-Structure-Property-Performance framework. The selected material for this review is titanium. Titanium is a silver metal that is strong, corrosion-resistant, and chemically inert. Processing, structure, properties, and performance are the four basic components in materials science and engineering. The linear structure depicted in the figure below is critical for systematic design and explains the interconnections of these linked aspects.



Titanium in Engineering Applications

AEROSPACE

Titanium goods are most commonly used in the aerospace sector. Because of its high strength-to-weight ratio and high temperature qualities, it is a suitable material for this sector. Titanium is commonly utilized in aircraft components and fasteners.

OCEAN

Titanium is desirable for ocean engineering applications due to its high corrosion resistance. As a result, several titanium products have been used in seawater desalination, as well as boats for maritime resource exploitation.

MEDICAL

Titanium has become a medical industry mainstay because it resists corrosion, is biocompatible, and has a natural capacity to link with human bone. Medical and dental titanium has genuinely become the primary material used in medicine, from surgical titanium equipment to orthopedic titanium rods, pins, and plates.

AUTOMOTIVE

Titanium was initially used in the engine sections of racing vehicles in the automotive industry. Since then, titanium's range of uses has grown to include muffler systems for super short-type bikes and limited-edition versions of high-performance vehicles.

Components Of PSPP

Process — Converting raw materials into final items through a sequence of phases.

Structure — The structure of a material is associated to the arrangement of its fundamental components.

Properties — A property is a material characteristic that identifies the type and magnitude of a response to a given input.

Performance — A material's performance is Qualities that must be demonstrated for a material to meet the criteria of an International Standard

PSPP of Titanium

in this project our main discussion is centered around a PSPP map of Titanium fabricated using AM

Process

Additive manufacturing (AM) is sophisticated method for manufacturing Titanium because it provides powerful solutions for cost-effectively and waste-free production of any type and quantity of items.

Structure

There are two crystal structures for titanium: titanium and titaniu. The hexagonal close-packed (HCP) structure of alpha titanium is created when it crystallizes at low temperatures (room temperature). The body-centered cubic (BCC) structure of beta titanium is created when it crystallizes at high temperatures.

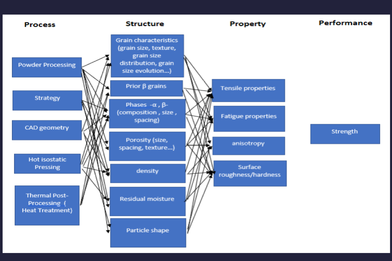
Properties

Titanium alloys are materials made up of titanium and other chemical elements. The tensile strength and toughness of such alloys are quite high (even at extreme temperatures). They are lightweight, have excellent corrosion resistance, and can withstand severe temperatures.

Performance

Titanium is highly valued in the metals industry for its high tensile strength, It's as strong as steel, but only 45 percent the weight and it's twice as strong as aluminum. In cyclic loading, the TiAl6V4 alloy has a reasonably high resistance. The severity of fatigue damage, on the other hand, is determined by the additive components' composition, microstructure, surface treatment, and the magnitude and kind of applied stress.

This Data must be implemented in the PSPP map below



A PSPP map represents the behavior of a specific material system