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High-temperature alloys-SLM

Description

GH4169 (equivalent to Inconel 718) 3D printing material is a nickel-based precipitation-hardening superalloy powder specifically engineered for additive manufacturing processes such as SLM and EBM. Commonly referred to as a high-temperature nickel-based alloy, it is characterized by high strength at elevated temperatures, excellent corrosion resistance, age-hardenability, and the capability to form complex geometries. It stands as a core 3D printing material for critical applications in the aerospace, energy, and high-end mold industries.

Features

Feature: High strength, high toughness, corrosion resistance, oxidation resistance

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Typical Applications

Aerospace: Engine turbine disks, compressor disks, blades, fasteners, casings; rocket engine nozzle components

Energy: Gas turbine high-temperature blades, disks, combustion chambers; nuclear power control rod drive mechanisms, heat exchangers

Petrochemical: High-temperature and high-pressure hydrogen reactors, heat exchanger tubes, valves, fasteners

Marine engineering: Deep-sea platform drive shafts, valves, corrosion-resistant structural components

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Parameters

Material		Nickel-based superalloy
Designation		GH4169
Main compositions		Ni: 50-55%
		Cr: 17-21%
		Fe: bal
Physical properties	Powder particle size	15-53 μm
	Flowability (s/50g)	14
	Tap density (g/cm³)	4.9
	Apparent density (g/cm³)	4.41
Compactness	Density	8.24
	Theoretical density of the sample	≥99%
As-built properties	Hardness	220HV
	Tensile strength/Rm	1158 MPa
	Yield strength/Rp0.2	914 MPa
	Elongation at break /A	14%
	Reduction of area/Z	/
	Elastic modulus/E	/

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1. Main Alloying Elements (Core Composition)

Elements	Mass fraction range	Primary function
Ni (nickel)	50.0~55.0	Alloy matrix; ensures high-temperature stability and corrosion resistance
Cr (chrome)	17.0~21.0	Forms a dense oxide film; enhances oxidation and corrosion resistance
Fe (iron)	Balance	Balances cost; contributes to mechanical properties
Nb+Ta (Niobium + Tantalum)	4.75~5.50	Key strengthening element; forms the primary γ'' strengthening phase
Mo (Molybdenum)	2.80~3.30	Solid solution strengthening
Ti (Titanium)	0.65~1.15	Assists in forming γ' strengthening phase; enhances high-temperature strength
Al (Aluminium)	0.20~0.80	Participates in forming γ' phase; improves high-temperature stability
Co (Cobalt)	≤1.00	Improves microstructural stability at elevated temperatures