Haynes® 214®

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Material & Process Capability

Haynes® 214® alloy (UNS N07214) is a nickel-chromium-aluminum-iron alloy, developed to provide the optimum in high-temperature oxidation resistance, while at the same time allowing for conventional forming and joining.

Intended principally for use at temperatures of 1750 °F (955 °C) and above, Haynes 214 alloy exhibits resistance to oxidation that exceeds many conventional heat-resistant alloys at these temperatures. This is attributable to the formation of a tightly adherent Al2O3-type protective oxide scale. This oxide scale also makes Haynes 214 ideal for use in high temperature oxygen environments found in some rocket engines in the pre-burner and main combustion sections.

General Process

This data sheet specifies the expected mechanical properties and characteristics of this alloy when manufactured on a Velo3D Sapphire System.
All data is based on parts built with Velo3D standard 50 µm layer thickness parameters, using Praxair TruForm 214-N51, a Velo3D approved powder.

Density, g/cc (lbs/cubic in)	8.05 (0.291)
Relative Density, percent	99.9+
Surface Finish[1], S_a, µm (µin)	<15 (590)

Mechanical Properties at Room Temperature

			After Heat Treatment[3]					
Property[2]			Ultimate Tensile Strength, MPa (ksi)		Yield (0.2% Offset), MPa (ksi)		Elongation At Break, percent	
Process Recipe	TBR (cc/h)[4]	Sample Size	Mean	Min	Mean	Min	Mean	Min
310W/50 µm	18	30[5]	960 (139)	955 (139)	646 (94)	640 (93)	37.5	35
500W/50 µm	30	34[5]	985 (143)	975 (141)	687 (100)	680 (99)	35.8	34

1. For angles >25° from horizontal, actual finish depends on orientation and process selected.
2. Mechanical & test samples printed in vertical orientation, machined to ASTM E8 (round specimen #3).
3. HIP at 1163 °C ± 12 °C (2125 °F ± 22 °F) for 180 min, 15ksi (±1ksi). Heat treat per AMS 2774: heat at 316 °C /h (600 °F /h) to 538 °C ± 28 °C (1000 °F ± 50 °F), hold for 15-30 min, heat at 482 °C /h (900 °F /h) to 1093 °C ± 14 °C (2000 °F ± 25 °F) for 30 +5/-0 min, argon quench at 0.9 bar or greater.
4. TBR: Theoretical Build Rate (TBR) is a per-laser build rate calculated from the process conditions of bulk core as *scan speed x hatch spacing x layer thickness*. This value represents a single laser only and is reported for comparison purposes across different materials and recipes, but does not correspond to true build rate, which is dependent on geometry and system characteristics (i.e. number of lasers, recoat times, etc.)
5. Data collected from single Sapphire printer.