HASTELLOY® C22®

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Material & Process Capability

HASTELLOY® C22® (N06022) is one of the most versatile alloys available today with resistance to both uniform and localized corrosion and a variety of mixed industrial chemicals. It is used in severely corrosive environments with high chloride and high temperature conditions, such as flue-gas scrubbers, nuclear fuel re-processing, sour gas handling, and pesticide production. It provides superior protection from pitting, crevice attack, and stress corrosion cracking.

The Velo3D intelligent additive printing solution uniquely enables companies to build the parts they need without compromising design or quality - resulting in complex parts higher in performance than traditional casting techniques or other additive methods.

General Process

HASTELLOY® C22® contains chromium, molybdenum, tungsten, and iron, making the alloy resistant to seawater corrosion. It exhibits excellent weldability and is easily fabricated into industrial components. This datasheet specifies the expected mechanical properties and characteristics of this alloy when manufactured on a Velo3D Sapphire System.

All data is based on parts built using Velo3D standard 50 µm layer thickness parameters, using Praxair TruForm C22, a Velo3D-approved HASTELLOY® C22® powder. HASTELLOY® is a registered trademark of Haynes International, Inc.

Corrosion[1]

- ASTM G28A: Corrosion rate noted after 24 hrs is 29 mils/year
- ASTM G36: No cracking in 48 hrs
- ASTM G48B : No pitting, crevice corrosion or weight loss noted in 48 hrs
- ASTM G150: No pitting or crevice corrosion noted up to 85° C

Process Data

Density, g/cc (lbs/cubic in)	8.69 (0.313)
Relative Density, percent	99.9+
Surface Finish[2], S_a, µm (µin)	<15 (590)

Mechanical Properties at Room Temperature

Property[3]			Modulus of Elasticity, GPa (msi)		Ultimate Tensile Strength, MPa (ksi)		Yield (0.2% Offset), MPa (ksi)		Elongation At Break, percent	
Process Recipe	TBR (cc/h)[4]		Min	Average	Min	Average	Min	Average	Min	Average
1kW/50 µm	45	As printed w/o Stress Relief	141 (21)	176 (26)	780 (113)	784 (114)	520 (75)	537 (78)	34.5	38.3
		As printed w/ Stress Relief [6]	158 (23)	163 (24)	840 (122)	845 (123)	490 (71)	493 (72)	39.5	41.6
		w/o Stress Relief, after HIP [5]	173 (25)	206 (30)	720 (104)	722 (105)	380 (55)	386 (56)	31	43.3
		w/ Stress Relief [6], after HIP [5]	156 (23)	160 (23)	705 (102)	710 (103)	420 (61)	423 (61)	55.5	56.5

1. Results were also obtained for commercially available rolled material and found to be comparable. **2.** Depends on orientation and process selected; for angles >25° from horizontal. **3.** Mechanical & test samples printed in vertical orientation, machined to ASTM E8 (round specimen #3). **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.** HIP at 100 MPa, 1120°C±15°C (2050°F±27°F), hold for 240±60 min and cool under inert atmosphere to below 425°C (800°F). **6.** Stress relief at 1038°C±14°C (1900°F±25°F) for 45 min and air cool. Mechanical properties were also checked in the following states and verified to be within ASTM B575 specification: Vertical orientation, net shape (not machined) / Horizontal orientation / Horizontal orientation using both lasers (stitch line at gauge region of tensile bar).