Material Data Sheet

316L Stainless Steel (UNS S31603)

Wipro 3D – 316L Stainless Steel

316L grade stainless steel, sometimes referred to as A4 stainless steel or marine grade stainless steel, is the second most common austenitic stainless steel after 304/A2 stainless steel. This document provides information and data for parts built using 316L powder – 40 µm layer thickness on EOS M280/M290 with Laser Powder Bed Fusion (LPBF) process.

Characteristics

Parts built from the 316L have the chemical composition corresponding to UNS S31603. Grade 316L, the low carbon version of 316 and is immune from sensitization (grain boundary carbide precipitation). The austenitic structure also gives these grades excellent toughness, even down to cryogenic temperatures. Compared to chromium-nickel austenitic stainless steels, 316L stainless steel offers higher creep, stress to rupture and tensile strength at elevated temperatures. The addition of molybdenum provides greater corrosion resistance than 304, with respect to localized corrosive attack by chlorides and to general corrosion by reducing acids, such as sulfuric acid.

Applications

- Chemical and Petrochemical Industry,
- Food Processing,
- Pharmaceutical Equipment,
- Medical Devices,
- Potable Water,
- Wastewater Treatment, Marine Applications And
- Architectural Applications Near the Seashore or In Urban Areas.

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Chemical Composition

Table 1: Chemical Composition of 316L (weight %)

Element	Minimum	Maximum
Chromium – Cr	17.00	19.00
Nickel – Ni	13.00	15.00
Molybdenum – Mo	2.25	3.00
Carbon – C	-	0.030
Manganese – Mn	-	2.00
Copper – Cu	-	0.50
Phosphorous – P	-	0.025
Sulphur – S	-	0.010
Silicon – Si	-	0.75
Nitrogen – N	-	0.10
Iron – Fe	Balance	

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Microstructure

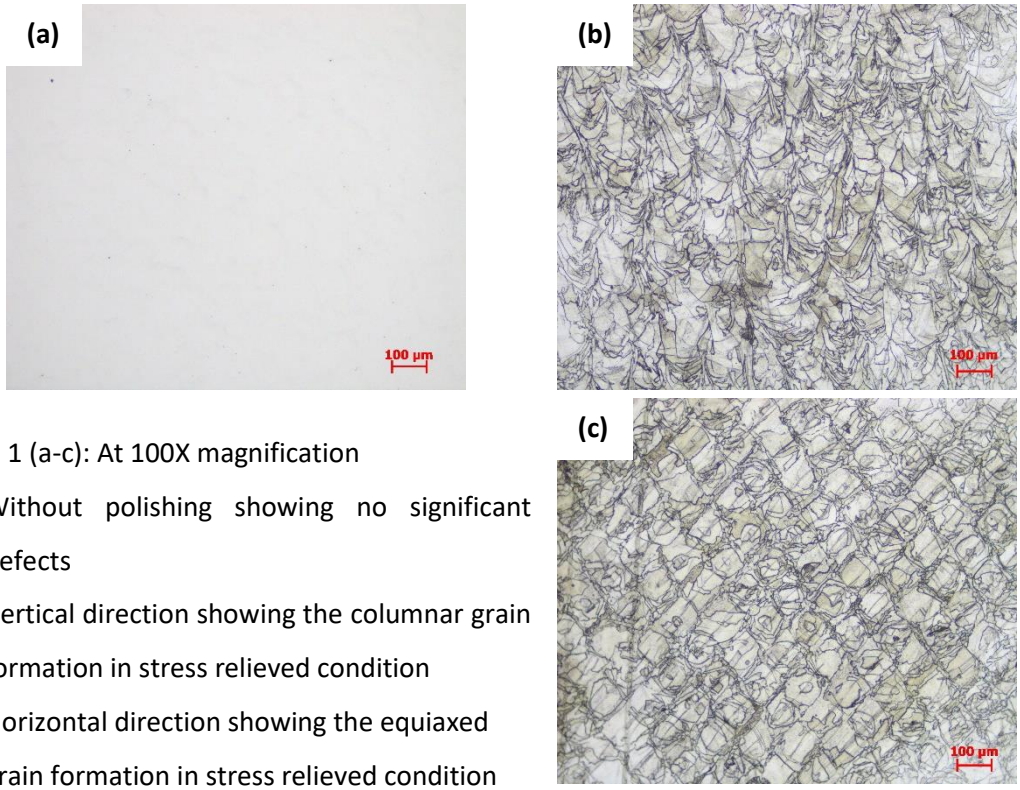

Figure 1 (a-c): At 100X magnification

(a) Without polishing showing no significant defects

(b) Vertical direction showing the columnar grain formation in stress relieved condition

(c) Horizontal direction showing the equiaxed grain formation in stress relieved condition

Mechanical Properties

Table: Stress Relieve condition properties of 316L

Properties	Values
Tensile Strength (MPa)	>600
Yield Strength (MPa)	>400
Elongation (%)	>30
Reduction Area (%)	>35
Hardness (HBW)	>170
Density (g/cm^3)	≥7.90
Inter Granular Corrosion	Acceptable as per ASTM A262, Grade 316L in Table 1

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Quality Assurance

The quality of the delivered 316L Stainless Steel components are ensured by the Quality Assurance procedures which are part of Wipro3D Quality Management System. The procedures include quality assurance of both the powder and process.

Table 3: Quality assurance of 316L powder and process

Powder Quality	Process Quality
Sampling (ASTM B215)	Micro examination (ASTM E3/E407)
Chemical Composition (ASTM E2823/E1479/E1019)	
Particle Size Distribution (ASTM B822)	Tensile Test (ASTM E8/E8M)
Flow Rate (ASTM B213/B964)	Density (ASTM B311)
Apparent Density (ASTM B212/B417)	Hardness (ASTM E10)
Tap Density (ASTM B527)	Inter Granular Corrosion test (ASTM A262)

Disclaimer: While every reasonable effort has been made to ensure that the information contained in this data sheet is correct, there is no guarantees or warranties (express or implied) concerning the accuracy or completeness of the information provided and expressly excludes all liabilities for any inaccuracies in this document or failure to achieve the stated levels.

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