

### Wipro 3D – AlSi10Mg

Aluminium Alloy – AlSi10Mg is most widely used for light weight material in aerospace and automotive applications. This document provides information and data for parts built using AlSi10Mg powder – 30µm & 60µm layer thickness in M400 machine with Laser Powder Bed Fusion (LPBF) process.

### Characteristics

Parts are built from the powder having the chemical composition as given below. It offers good strength, hardness and dynamic properties and is therefore also used for parts subject to high loads. Parts in AlSi10Mg are ideal for applications which require a combination of good thermal properties and low weight. The laser-sintering process is characterized by extremely rapid melting and re-solidification. This produces a microstructure and corresponding mechanical properties in the as-built condition which is similar to heat-treated cast parts.

### Chemical Composition

Chemical composition of raw material and built parts is compliant to table given below.

Element	Limits (weight%)
Silicon – Si	9.00 - 11.00
Magnesium – Mg	0.25 - 0.45
Iron – Fe	max. 0.40
Titanium – Ti	max. 0.15
Manganese – Mn	max. 0.10
Zinc – Zn	max. 0.10
Copper – Cu	max. 0.03
Nickel – Ni	max. 0.05
Tin -	max. 0.05
Lead	max. 0.05
Oxygen	max. 0.15
Beryllium	max. 0.002
Other Elements, each	max. 0.05
Other Elements, total	max. 0.15
Aluminum	Remainder

## Microstructure

Microstructure of built parts:

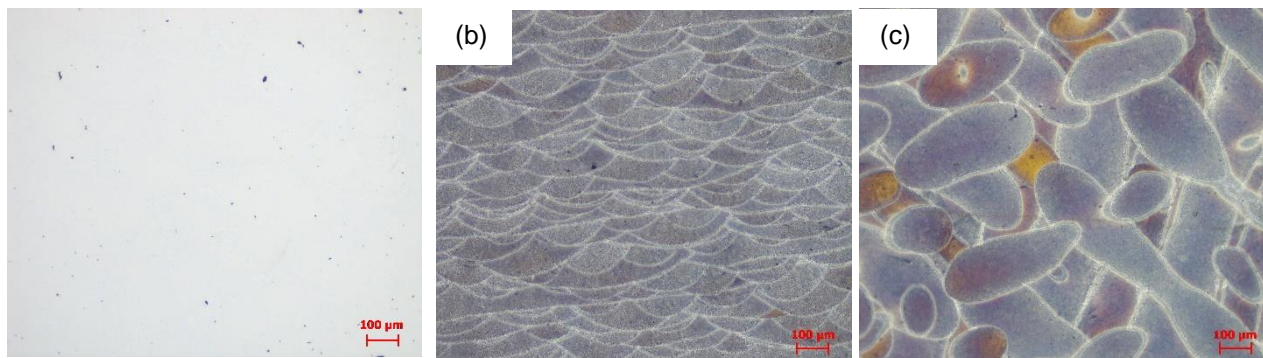


Figure (a-c): At 100X magnification – (a) Without polishing showing 0.12% porosity; (b) Vertical direction showing the columnar grain formation in stress relieved condition; (c) Horizontal direction showing the equiaxed grain formation in stress relieved condition

## Mechanical Properties

Mechanical properties of built parts confirm to below.

Table 1: As built, minimum properties of AlSi10Mg

Layer Thickness vs. Spec	30 µm	60 µm
Tensile Strength (MPa)	>390	>390
Yield Strength (MPa)	>220	>220
Elongation (%)	> 4	> 3.5
Hardness (HBW)	> 85	> 85
Density (g/cm <sup>3</sup> )	min. 2.6	

There are various heat treatment methods for improving yield strength and/or elongation, hence if the user provides exact requirements, it can be discussed to achieve these properties.

## Quality Assurance

The quality of the delivered AlSi10Mg component is 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.

Powder Quality	Process Quality
Sampling (ASTM B215)	Micro examination (ASTM E3/E407)
Chemical Composition (ASTM E716/E1251/E3061/E2792)	
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)

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