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A356

Description

A356 is a cast aluminum alloy in the Al-Si-Mg system, representing a high-purity modified version of the 356 alloy. A356 is the preferred cast aluminum alloy for automotive wheels and engine components, offering a balance of lightweight properties, strength, and cost-effectiveness.

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Material Properties of A356 Aluminum Alloy

1. Chemical Composition (Mass Percentage %)

Elements	Composition Range	Note
Aluminum (Al)	Balance (≥92.05%)	Base metal
Silicon (Si)	6.5 - 7.5	Improved fluidity and castability
Magnesium (Mg)	0.25 - 0.45	Reinforcing element, hard enable by heat treatment
Iron (Fe)	≤ 0.20	Stringent control of impurities
Copper (Cu)	≤ 0.20	Excessive amounts of impurities may reduce corrosion resistance
Zinc (Zn)	≤ 0.10	Impurities
Manganese (Mn)	≤ 0.10	Impurities
Titanium (Ti)	≤ 0.20	Grain refiner
Other impurities	≤0.05 for individual, ≤0.15 for total	-

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2. Physical Properties

Performance parameters	Values (Metric)	Values (Imperial)	Note
Density	2.68 g/cm³	0.097 lb/in³	Lightweight properties
Melting range	557 - 613°C	1035 - 1135°F	Solidus–Liquidus range
Coefficient of thermal expansion	21.5 × 10^{-6} /°C	11.9 × 10^{-6} /°F	20-100°C
Thermal conductivity	149 - 155 W/(m·K)	86 - 90 Btu/(ft·h·°F)	T6 temper
Electrical conductivity	33 - 40% IACS	-	Moderate electrical conductivity
Elastic modulus	72.4 GPa	10.5 × 10^{6} psi	-
Poisson's ratio	0.33	-	-
Specific heat capacity	963 J/(kg·K)	0.230 Btu/(lb·°F)	20°C
Thermal diffusivity	60 × 10^{-6} m²/s	-	-

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3. Mechanical Properties (by Heat Treatment Condition)

Performance parameters	As-cast (F)	T5 temper	T6 temper (sand cast)	T6 temper (permanent mold)
Tensile Strength	165-207 MPa	207-241 MPa	234-310 MPa	276-345 MPa
Yield strength	83-124 MPa	152-186 MPa	165-234 MPa	207-276 MPa
Elongation	3-5%	3-6%	3-10%	5-12%
Brinell Hardness HB	50-65	65-80	70-90	80-100
Fatigue strength (10^7 cycles)	55-70 MPa	70-85 MPa	90-110 MPa	100-125 MPa
Shear strength	124-145 MPa	145-165 MPa	165-186 MPa	186-207 MPa
Impact toughness (Charpy)	4-8 J	6-10 J	10-15 J	12-18 J
Fracture toughness K_IC	18-22 MPa√m	20-24 MPa√m	22-28 MPa√m	25-32 MPa√m

4. Equivalent Designation Cross-Reference

Standard system	Designation
China	ZL101A
Japan	AC4CH
Germany	AlSi7Mg (EN AC-42000)
France	A-S7G03
UK	LM25
Russia	АЛ9-1
ISO	AlSi7Mg

5. Typical Applications

Automotive industry: Wheels, engine blocks, transmission housings, oil pans, rear axle housings

Aerospace: Structural castings, brackets, housings (non-load-bearing components)

Marine industry: Propellers, impellers, pump housings (seawater corrosion resistant)

General machinery: Pump bodies, valve bodies, fan housings, heat exchangers

6. Summary of Key Features

Excellent casting performance: Good fluidity and strong feeding capacity, suitable for complex thin-walled parts

Heat treatable for strengthening: Strength can be significantly improved through T6 treatment (solution heat treatment + artificial

aging).

Good corrosion resistance: Easily forms an oxide film on the surface, resistant to atmospheric and seawater corrosion

Excellent weldability: Suitable for various welding processes

Good machinability Excellent machinability after T6 tempering; suitable for anodic oxidation

Note: A356 is an improved version of 356 with stricter impurity controls (especially iron and copper).

Therefore, it offers better ductility and pressure tightness and is commonly used in applications requiring higher performance.