

Comprehensive Guide to 7075 Aluminum

Introduction to 7075 Aluminum

7075 Aluminum is one of the strongest aluminum alloys available, renowned for its incredible strength-to-weight ratio and outstanding mechanical properties. Developed initially for aerospace applications, 7075 has become a go-to material for industries requiring high performance and reliability in critical parts. Its composition, dominated by aluminum, zinc, and magnesium, contributes to its exceptional strength and durability, making it ideal for demanding environments.

This guide offers a detailed look at 7075 Aluminum's properties, benefits, applications, machinability, and finishing options, equipping industry professionals with the insights needed to maximize its potential.

Properties of 7075 Aluminum

The defining feature of 7075 Aluminum is its remarkable combination of lightweight properties and tensile strength, rivaling even some steels. Below are its key mechanical, chemical, and thermal properties.

Mechanical Properties

Property	Typical Value	Unit
Ultimate Tensile Strength	572 MPa	Megapascals (MPa)
Yield Strength	503 MPa	Megapascals (MPa)
Elongation at Break	11%	Percentage (%)
Hardness (Brinell)	150 HB	Brinell Hardness Number
Modulus of Elasticity	71.7 GPa	Gigapascals (GPa)
Fatigue Strength	159 MPa (500 million cycles)	Megapascals (MPa)

These properties highlight its exceptional strength and fatigue resistance, making it suitable for applications in high-stress scenarios.

Chemical Composition

7075 Aluminum's strength is enhanced by its unique chemical composition, which primarily includes zinc as the main alloying element.

Element	Typical Percentage
Aluminum (Al)	87.1 - 91.4%
Zinc (Zn)	5.1 - 6.1%
Magnesium (Mg)	2.1 - 2.9%
Copper (Cu)	1.2 - 2.0%
Silicon (Si)	≤ 0.4%
Iron (Fe)	≤ 0.5%
Chromium (Cr)	0.18 - 0.28%

The addition of zinc, copper, and magnesium enhances hardness, while chromium improves resistance to corrosion.

Thermal and Electrical Properties

Property	Value	Unit
Melting Point	477 - 635 ° C	Degrees Celsius (° C)
Thermal Conductivity	130 W/m-K	Watts per meter per Kelvin
Electrical Conductivity	33% IACS	International Annealed Copper Standard
Coefficient of Thermal Expansion	23.5 μm/m-° C	Micrometers per meter per degree Celsius

7075 Aluminum offers moderate electrical and thermal conductivity, suitable for environments where heat dissipation is not the primary concern.

Benefits of Using 7075 Aluminum

Known for its performance and reliability, 7075 Aluminum delivers several key benefits:

- **High Strength:** With superior tensile strength, this alloy meets the requirements of harsh, high-stress applications.
- **Lightweight:** Provides the strength of steel at a fraction of the weight, ideal for aerospace and automotive sectors.
- **Fatigue Resistance:** Exceptional endurance under cyclic loading, making it perfect for structural components.
- **Corrosion Resistance (Conditional):** Enhanced resistance, especially with protective finishes such as anodizing, but relatively lower than other aluminum grades like 6061.
- **Heat Treatable:** Heat treatments, such as T6 tempering, increase its strength significantly, making it extremely durable.

These combined characteristics establish 7075 Aluminum as an exceptional material for critical applications.

Applications of 7075 Aluminum

Due to its unique properties, 7075 is often the material of choice for industries pushing the limits of engineering, such as aerospace, military, and high-performance automotive.

Industry	Examples of Applications
Aerospace	Aircraft wings, fuselage frames, structural components
Defense	Missile components, tactical gear, armor plating
Automotive	Racing car components, chassis, suspension parts
Marine	High-performance boat parts, fasteners, swing keels
Recreational Sports	Bicycles, climbing equipment, snowboards, archery bows
Electronics	Lightweight protective housings, durable connectors

Its combination of strength and lightweight features makes it ideal for high-stakes and performance-driven applications.

Machinability of 7075 Aluminum

7075 Aluminum is reasonably machinable, although its hardness presents certain challenges. It requires proper tooling and strategies to achieve optimal results.

Machinability Rating 80% (Good)

Tips for Machining

- **Use Hard Tools:** Opt for carbide or diamond-coated tools to manage the material's hardness.
- **Coolant Application:** Utilize cutting fluids to dissipate heat and extend tool life.
- **Optimal Cutting Speeds:** Maintain moderate feed rates and spindle speeds to prevent overheating.

Despite its challenges, machining 7075 is manageable with the right equipment and techniques, leading to precision-crafted components.

Surface Finishing Options for 7075 Aluminum

Applying a surface finish to 7075 Aluminum can significantly enhance its corrosion resistance and aesthetic appeal. Common finishing options include:

Finish Type	Process Description	Key Applications
Anodizing	Electrochemical process to add a protective, corrosion-resistant oxide layer.	Aerospace, marine parts, racing bicycles.
Powder Coating	Durable, decorative coating of powdered material cured under heat.	Automotive parts, outdoor equipment.
Polishing	Mechanical buffing to achieve a reflective surface.	High-end consumer goods and luxury automotive components.
Bead Blasting	Produces a matte finish by blasting fine media particles onto the surface.	Industrial and sporting.

Choosing the right finish depends on the specific use case and environmental exposure of the component.

Comparing 7075 to Other Aluminum Grades

Property	7075 Aluminum	6061 Aluminum	5052 Aluminum
Strength	Superior	High	Moderate
Corrosion Resistance	Good	Excellent	Excellent
Machinability	Good	Excellent	Moderate
Weldability	Poor	Excellent	Good
Applications	Aerospace, defense, racing	Structural applications	Marine, pressure vessels

7075 Aluminum outshines other alloys in strength but is less versatile in corrosion resistance and weldability without additional treatments.

Summary and Key Takeaways

7075 Aluminum is engineered for strength-critical, high-demand applications. Its superior tensile strength, fatigue resistance, and lightweight properties make it an unparalleled choice for sectors like aerospace, defense, and high-performance automotive. While it requires specific care during machining and finishing, the results are premium components capable of withstanding extreme conditions.

Download this guide for a complete reference to optimize your designs and processes utilizing 7075 Aluminum.

Contact Us

For questions or project quotes, reach out to Essengold today and explore how our expertise with 7075 Aluminum can transform your components into high-performance solutions!