The Complete Guide to Aerospace Machining Materials

WORLDWIDE INSTRUMENT PARTS CO.
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CNC aerospace machining creates durable, precise components according to stringent industry requirements. CNC machining uses a combination of computer-controlled machinery and advanced software to cut raw materials into complex geometries. From the metal outer shell of an aircraft to highly intricate small parts, this manufacturing technique helps turn blueprints into expertly constructed finished products.

This process is widely used throughout the aerospace industry and is an ideal option for challenging projects that could not be completed using other types of tools. Since a computer controls the machine's movement, human errors are eliminated.

At WIPCO, we work with a number of materials that perform reliably in aerospace applications, including aluminum, titanium, and exotic alloys. In this guide, we'll discuss the characteristics of aerospace materials and the applications they're used in.

Material Types

Aerospace materials must be lightweight yet exceptionally durable to withstand flight conditions. Many materials can meet these performance demands, like aluminum, titanium, and carbon composites. With CNC machining technology, even high-strength materials can be shaped into precise components.

Aluminum

Aluminum is a commonly used material for aerospace components due to its lightweight nature and high corrosion resistance. It is highly ductile and can be easily machined using CNC technology. Some of the most commonly used aluminum alloys for aircraft applications include 2024 for forming structural components and 7075 for higher-stress applications like landing gear.

Titanium

Titanium features a high strength-to-weight ratio which makes it a great option for aerospace environments. It is also corrosion-resistant, which is an important characteristic for parts that will be exposed to harsh environmental conditions. Titanium is used to construct everything from engine parts to hydraulic systems and precise structural components.

Magnesium

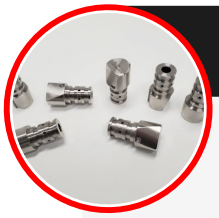
Magnesium is the lightest of all structural metals and is a great choice for constructing weight-sensitive products. It offers excellent thermal conductivity and is easy to machine using CNC technology. It is often used in low-stress applications like aircraft seat frames and luggage compartments.

Beryllium

A very lightweight material, beryllium features a high stiffness-to-weight ratio. It is also highly toxic, which makes it challenging to machine. CNC parts designers must take safety precautions when working with this material. Beryllium is often used to craft aerospace components that must be stiff, such as telescopes, mirrors, and satellites.

Carbon Composites

Carbon composites are a combination of carbon fiber and epoxy resin. They are lightweight, stiff, and fatigue-resistant. In recent years, they have gained widespread attention throughout the aerospace industry for their notable strength and durability. Since they can withstand extreme weather conditions easily, they are often used to make aircraft wings, skins, and landing gear.



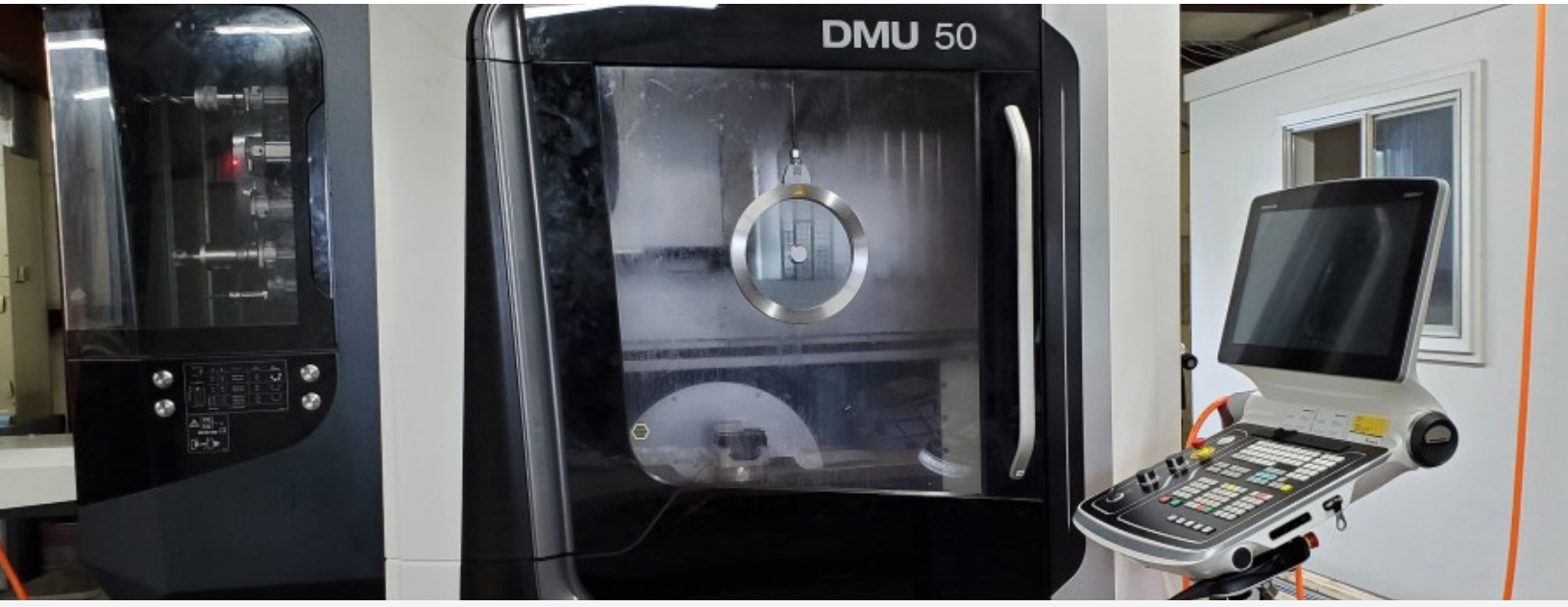
Stainless Steel

Stainless steel is widely known for its corrosion resistance and ability to endure harsh environments. It is a durable material that provides excellent tensile strength and endures extreme temperatures. These characteristics make it well-suited for manufacturing jet engines, which must perform reliably in high-temperature environments.

One potential drawback to stainless steel is its weight. While it offers greater strength than materials like aluminum, it is also heavier and is not the best option for applications where weight is a primary concern.

Inconel

Inconel is a superalloy. Superalloys are metals that provide better corrosion resistance, creep, and oxidation than traditional alloys. Inconel is heavier than titanium but is still valued throughout the aerospace industry due to the strength and durability it provides. It is uniquely suitable for aerospace applications, withstanding high temperatures and high-pressure environments while reliably resisting corrosion.



Applications

CNC-machined materials are used throughout an array of aerospace applications. Internal and external aircraft parts, satellites, spacecraft components, and more are created with CNC machining techniques. Below, you can learn about some of the most common aerospace applications for precision-machined parts.

Cooling systems

CNC machining techniques create the cooling systems necessary to maintain optimal engine and cabin temperature.

Communication devices

Aerospace machinery requires sophisticated communication systems. Many communication device components are created using precision CNC machining.

Control panels

CNC aircraft machining creates aircraft control panel components like displays, switches, and knobs.

Control systems

Actuators and sensors are vital parts of aircraft control systems. CNC machining delivers the precision necessary to ensure these important parts perform reliably.

Engine parts

Everything from housings to turbine blades must be well-crafted to keep engines running smoothly.

Electrical connectors

Aircraft electrical systems are subjected to space and weight constraints. CNC machining ensures electrical connectors are lightweight yet durable enough to perform reliably.

Instruments and tools

Instruments like altimeters and many other specialized tools are manufactured using CNC machining.

Interior construction

Everything from seat frames to overhead compartments must be constructed from lightweight yet durable materials. CNC machining ensures these components are not only functional but aesthetically pleasing as well.

Interior components

Many types of aircraft interior furnishings are produced using CNC machining techniques. With the right materials, everything from seat frames to overhead compartments can be durable yet lightweight.

Oxygen generation components

Oxygen-generating safety systems are crafted from temperature-resistant, high-strength materials.

Prototyping

CNC machining allows the operator to rapidly produce prototypes, which is essential when developing new component designs.

Robotic arms and equipment

Many types of spacecraft use robotic systems for maintenance or repair purposes, as well as scientific exploration applications. Using CNC machining techniques allows for greater precision.

Shafts

Shafts play an important role in power transmission within aerospace applications. CNC machining techniques easily accommodate the strong, heat-resistant materials used with these components.

Structural components

Both small and large-scale aircraft structural components are produced using CNC machining techniques. Everything from landing gear to the aircraft wings and fuselage is precision-machined using this technology.

Space vehicle parts

Any component that will be used in space must be extremely durable. CNC machining easily handles the heavy-duty, challenging materials involved in these applications, producing everything from satellite dishes to rocket components.

Spacecraft components

Spacecraft fuel systems, heat shields, and numerous other components must meet stringent performance specifications. CNC machining ensures these mission-critical parts perform flawlessly under extreme conditions.

Satellites

Satellites involve numerous intricate components that must be precision machined to ensure reliable performance. CNC manufacturing techniques create everything from communication systems to solar panels, safeguarding the reliability of global communication and space exploration.

Valve components

In addition to creating large products, CNC machining is also suitable for producing small components like valves with high accuracy. These products are used throughout numerous aerospace applications.

Aerospace Machining from WIPCO

Precision machining is essential to ensure aerospace parts meet stringent safety and performance specifications. Using CNC machining techniques, the world's most high-performance materials can be transformed into reliable, lightweight components.

At Worldwide Instrument Parts Company, we have over 20 years of experience meeting these rigorous demands. We use the most advanced CNC mills, lathes, and screw machines to deliver turnkey parts on time.

To get started on your solution, contact our team today. We'll help you obtain expertly machined finished products at a fair price.

About Worldwide Instrument Parts

Founded in 2000, Worldwide Instrument Parts Company (WIPCO) is a specialty manufacturer of precision machined components. We work with customers on a variety of projects, from simple components made of easily machinable materials to highly complex parts made of high-temperature superalloys. In fact, our specialized expertise in superalloys and other challenging materials is a major reason customers keep coming back for our machining services.

As an ISO 9001:2015-certified, AS9100D-certified company, WIPCO is committed to delivering consistently high quality to our customers across the most demanding industries, including oil and gas, aerospace, military, automotive, telecommunications, pharmaceutical, and industrial equipment. Equipped with cutting-edge machining equipment, advanced CAD/CAM software, and high-precision inspection machinery, we can achieve tolerances as tight as ±0.0002”.

Contact us or request a quote to get started on your solution.

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