DATA SHEET
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Metals

Summary

Physical variables included in this documentation are provided by way of indication only and do not, under any circumstances, constitute a contractual undertaking. Please contact our technical service if you require any additional information.

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Overview

Final Advanced Materials offers the supply and the machining of a wide range of metals. They are mainly used in general and automotive engineering as well as in industrial structures.

Metals are available in a variety of sizes and shapes, and different treatments can be applied to improve their properties, depending on the expected performance characteristics.

Applications

- General mechanics
- Automotive
- Railway
- Aeronautics
- Construction
- Parts for chemical & hydrocarbon process lines
- Industrial screws and bolts in the construction industry
- Furnace parts

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Types of metals

STEEL

Steel for general use

Steel for general use is a construction steel which requires no additional treatment. Its mechanical performance is often broadly sufficient for use without severe constraints. It is easy to use: forming, assembly, machining, welding, folding.

The most used steel is steel A37 which is soft and non-alloy. It is suitable for mechanical parts requiring no particular stiffness, such as braces, rings or light axles.

Carbon steel

The main alloy component of these steels is carbon (between 2 and 2.5%). Low carbon content steels are weaker and softer, but can be machined and welded easily, whereas high carbon content steels are more resistant, but substantially more difficult to machine.

The most used carbon steels are C22 - XC18 (with a low carbon content) for its good surface resistance, and C45 - XC48 (higher carbon content), for its good machinability and its mechanical characteristics.

Case hardening steel

Case hardening steels have a carbon content of 0.10 to 0.20%. They are intended for case hardening and quenching, which lead to high stiffness in the core and substantially greater hardness at the surface. They have resilience in the core and hardness externally, giving them high wear resistance. At temperatures higher than 920°C carbon enrichment ("carbonisation" or "case hardening") occurs. Case hardening steels are generally used for mechanical parts for which a high surface hardness with satisfactory stiffness in the core is required.

The most used case hardening steels are 16MnCr5 and 16NC6, which have high impact and perforation resistance.

Heat treatment steel

Heat treatment steels are structural steels alloyed with nickel, chromium and molybdenum for quenching and tempering. They have excellent hardenability (self-hardening) even on large-dimension pieces. This type of steel is an excellent choice for many applications in leading industries where severe characteristics are demanded. Indeed, it has high endurance and stiffness limits, high wear resistance and low deformation. The most used steels are 42CD4T, 35NCD16 and 35CD4.

Nitriding steel

Nitriding steels are alloy tool steels with chromium, manganese and molybdenum for cold working. They have good hardenability and are suitable for all types of nitriding. This type of steel is recommended to produce plastic dies, die holding blocks for plastic and guide rails for machine tools. Dies and holding blocks manufactured with this steel require more heat treatment. This grade is always ready to use. The most used nitriding steel is 40CMD8.

STAINLESS STEEL

Martensitic steel

These steels contain a least 12% chromium and a maximum of 10% nickel. The carbon content is very low, 0.1% to 1.5%. The main advantage of this type of steel is its excellent hardenability by heat treatment. They are used when the mechanical resistance requirements are high. Due to the entirely martensitic structure, these steels have high elasticity, breakage resistance and hardness. However, this steel is not suitable for use at very low temperature.

Ferritic steel

The basic composition has a chromium rate higher than 12%, a nickel rate of under 2% and a carbon rate of under 0.2%. These steels have good ductility, offering satisfactory cold shaping properties. The corrosion resistance of these steels is far greater than that of martensitic steels. The best corrosion properties are obtained after heat treatment. However, this steel is not suitable for use at very low temperature.

Austenitic and superaustenitic steel

They are by far the most common stainless steels, due to their ductility, which is comparable to that of copper, and their high mechanical performance characteristics. The high nickel content (> 10%) appreciably improves corrosion resistance and resistance to aggressive environmental conditions. The chromium content is higher than 19%, and the carbon content is very low. Stability can be improved by elements such as titanium or niobium. Superaustenitic stainless steel has excellent general or localised corrosion resistance, in particular in highly oxidising environments. It should however be noted that there is a risk of corrosion under stress in certain chlorinated environments (e.g.: swimming pools).

The austenitic structure, and the malleability relating to it, result in excellent stiffness, even at low temperature. However, good stiffness results in poor machinability of the material. Austenitic steels are non-magnetic and cannot be treated by quenching.

Heat-resistant steel

Heat-resistant steels have high chromium and nickel contents. They resist corrosion, oxidisation and warm creep, and are principally used in heating or treatment furnaces. Service temperatures are between 900°C and 1,150°C. These steels retain satisfactory mechanical properties at high temperatures, but their plastic deformation is limited.

ALUMINIUM

Aluminium is a non-ferrous material. It has a low density and is a good thermal and electrical conductor. Aluminium is also a material which is easy to work. Its lightness makes it a preferential material: it has a very good density/mechanical performance ratio. Finally, aluminium can be recycled completely and infinitely, facilitating eco-design.

It is available in a wide range of sizes. When it is manufactured, various heat and mechanical treatments can improve its properties, depending on the expected performance characteristics.

Non-alloy aluminium

1000 series

Alloys in the 1000 series consist of aluminium which is 99% pure or higher. This series has very good plastic deformation properties, and excellent characteristics with regard to chemical agents and different atmospheres. It also has good welding, brazing and anodisation properties, and relatively low mechanical resistance.

The properties depend mainly on the quantity of impurities and the level of strain hardening or softening (annealing or recovery).

Thermosetting alloys

2000 series

In the 2000 series copper is used as the main alloy element and enables traction resistance to be increased using solution heat treatment. These alloys have an average mechanical resistance which depends on the heat treatment (T6 recommended). They have good heat resistance but poor welding properties and relatively low corrosion resistance in corrosive atmospheres. The most commonly used grades are 2017, 2011 and 2030.

6000 series

The alloys in this series contain silicon and magnesium. They have very good properties for hot deformation by lamination, and above all by extrusion and swaging and cold forming. They have very good corrosion resistance and good welding properties. Conversely, heat resistance is limited. Grades 6060 and 6082 are the most commonly used ones.

7000 series

Zinc is the main alloy agent of this series. It has very high mechanical resistance, but low stiffness and stress corrosion resistance.
The most commonly used grade is 7075 (FORTAL).

Non-thermosetting alloys

3000 series

Manganese is the main alloy element in this series, often with a small quantity of magnesium. However, only a small percentage of manganese can be added effectively to aluminium, i.e. 1.0% to 1.5%.

4000 series

The 4000 series is a special case, since it is both heat treatable and not heat treatable. Alloys in the 4000 series are combined with silicon, which can be added in sufficient quantities to reduce the melting point of aluminium, without affecting its fragility.

5000 series

Magnesium is the main alloy agent of the 5000 series, and is one of the most effective alloy elements, and one of the most commonly used for aluminium. Alloys in this series have good mechanical resistance, and effective weldability. They also have high corrosion resistance in marine environments. For this reason, aluminium and magnesium alloys are widely used in structural applications. The most commonly used grades are 5083 and 5754.

COPPER

Copper is an orange-coloured material with the chemical symbol Cu. It has a great variety of applications as it is ductile and malleable and has particularly high electrical and thermal conductive properties.

Copper is one of the most commonly used materials in the industrial sector, in particular in general mechanics. Its conductive properties and its technical and chemical characteristics make it a preferred material for the creation of a wide variety of parts. However, it has low mechanical resistance and can easily be deformed. It is therefore important to blend it with other materials to increase its resistance. Copper oxidises naturally in moisture and forms verdigris.

Machining it requires expertise and appropriate equipment to ensure satisfactory quality.

BRONZE

Bronze is a metal alloy consisting principally of copper, tin or aluminium, although other metals such as zinc, lead and nickel can also be added. Bronzes are characterised in general by their satisfactory mechanical properties, their wear resistance, their heat conduction and their electrical conductivity.

Special attention is required to machine bronze, which requires specific expertise and equipment.

INCONEL®

Inconel® is a registered trademark of Special Metals Corporation. In the metallurgical industry Inconels® are considered to form part of the range of superalloys of Nickel-Chromium. They have extremely high corrosion resistance and are used in very corrosive environments such as the nuclear industry. They can be used at up to over 800°C. However, they have very poor resistance in a reducing atmosphere.

We machine in particular the following grades:

- **Inconel® 625**, a nickel-chromium-molybdenum alloy with excellent corrosion resistance in many corrosive environments. The ideal choice for applications in salt water. Inconel® 625 is also known by the name Nicrofer 6020, Superimphy 625, Chronin 625, Haynes 625, Pyromet 625, Supermet 625 and Udimet 625.
- **Inconel® 718**, a nickel-chromium alloy with high resistance to breakage by creep at high temperature. Improved robustness and improved mechanical properties at low temperature than Inconel® X-750. Inconel® 718 is also known by the name Nicrofer 5219, Superimphy 718, Haynes 718, Pyromet 718, Supermet 718 and Udimet 718.

If your application requires a different quality of inconel please contact us.

BRASS

Brass is a non-magnetic and non-ferrous alloy consisting of copper and zinc. It is appreciated for its good machinability and the fact that it can be polished. Its physical properties depend greatly on its composition.

Brass can thus also be alloyed with other materials to improve certain properties, such as corrosion resistance or hardness.

It is often used in the manufacture of mechanical parts and plumbing fixtures.