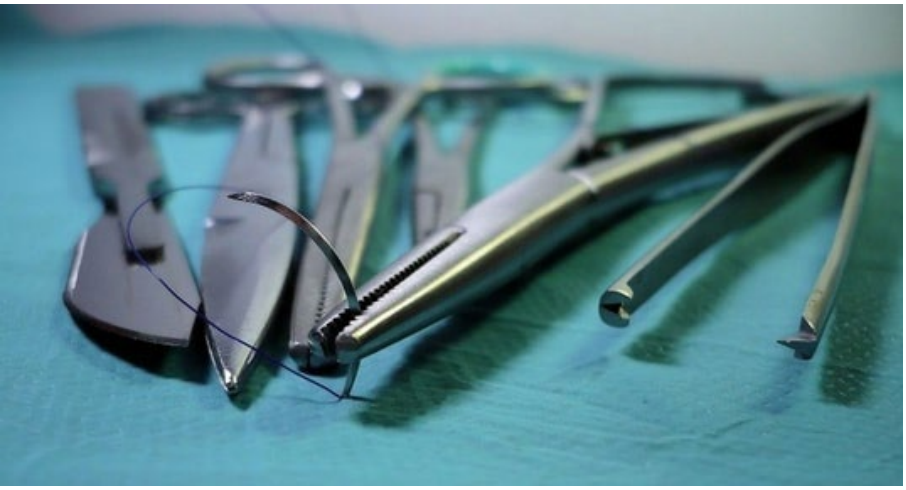
Which Metals Are Commonly Used for Surgical Instruments?

There are many different considerations when choosing a material to use in the medical industry. After all, the wrong material choice could lead to disastrous consequences. In this article, we take a look at which metals are used for surgical instruments, and why.

The most common metals used for surgical instruments are:

- Stainless steel
- Titanium
- Tantalum
- Platinium
- Palladium

Read on to learn why these metals were chosen. The metals used for surgical instruments have to adhere to strict criteria.



Firstly, the metal must be relatively malleable so it can be shaped without causing flaws, but not too malleable as it needs to hold its shape once manufactured. Depending on the instrument, the metal used may also need to be fairly ductile, as many surgical instruments are long and thin, e.g. scalpels, forceps, scissors, etc.

The surface of the metal needs to be tough and needs to have a satin finish, so the instruments are easy to clean and won't harbour bacteria, helping to

prevent the spread of infection. Finally, the metal needs to be inert with the human body, so it won't cause any metal contamination when used internally.

When it comes to biomedical instruments, not all metals are up to the job, especially base metals. In fact, most surgical instruments are made from metal alloys. Stainless steel has traditionally been the metal alloy of choice, but there are alternatives when necessary.

Stainless steel grades for surgical instruments

Stainless steel (sometimes referred to as inox steel) is one of the most commonly used metal alloys in the manufacture of surgical implements.

Austenitic 316 (AISI 316L) steel is a type of stainless steel used often, and is referred to as "surgical steel". This is because it is a tough metal that is very resistant to corrosion. It is also used frequently in the chemical industry.

AISI 301 is the most commonly used metal for manufacturing springs which are useful in medical instruments. It gains mechanical strength when cold-worked, but loses corrosion resistance.

Stainless steel can withstand temperatures as high as 400°C, meaning it can be sterilisedeasily in an autoclave at 180°C. It also has the benefit of being almost as tough and hard-wearing as carbon steel.

Interested in stainless steel? Then read this article – everything about stainless steel, its composition, categories, and applications.

Titanium in surgical tools

Titanium alloy has only recently started being used as a material for surgical instruments, taking off in the 1960s.

The most obvious benefit of titanium is its superior strength. Its tensile strength is almost the same as carbon steel and it is 100% corrosion resistant. Despite its overall strength, it is more flexible than stainless steel and is approximately 40% lighter.

"Read more about technologies and materials enabling surgical tools and biomedical implants. The article is written by an expert in the field – the Doctor of Medicine, Hugo Herrero Antón de Vez."

Read more about technologies and materials enabling surgical tools and biomedical implants. The article is written by an expert in the field – the Doctor of Medicine, Hugo Herrero Antón de Vez.

Titanium is perfect for both surgical instruments and implants, as it is biocompatible and has the intrinsic quality that it fuses well with human bones. For this reason, it has become the metal of choice for orthopaedic rods, pins, plates, and dental implants.

Titanium is more resistant to heat than stainless steel, withstanding up to 430°C, and it expands and contracts less when heated and cooled.

Depending on the properties required for the instrument, Titanium Grade 1 or 2 can be machined, welded, and hot or cold-worked quite easily, so it is a versatile metal too.

Overall, titanium is a tough, durable metal that has become a common material used for all kinds of medical purposes.

Tantalum in orthopaedics

Tantalum, a refractory metal, is strong, ductile and has a very high melting point (3017°C). But for the medical industry, its most attractive benefit is its high biocompatibility.

The metal is immune to bodily fluids, and also highly corrosion-resistant, so it can be used in surgery without causing adverse effects. For the same reasons, it's also used for implants and bone replacement material in prostheses.

Its ductility is also an attractive property, as it can be drawn into thin wire, while its malleability allows it to be easily fabricated into various shapes.

Platinum and palladium in medicine

Although platinum and palladium are expensive precious metals, they have similar properties that make them uniquely suited to certain surgical applications.

Firstly, they can both be easily formed into variety of shapes as they are highly malleable and ductile, meaning you can easily make rolls, sheets, tubes, wires, etc. They are especially useful for intricate parts, ideal for precision surgical instruments.

Both platinum and palladium are highly corrosion resistant and inert, so they won't cause problems when in contact with the body or internal organs.

One of the major uses in recent years has been creating ultra-thin wires that surgeons use to guide and position implants such as catheters and stents.

Another advantage is that both platinum and palladium show up very clearly on X-ray making them ideal to be used as markers on implants.

They are both strong, durable metals. The only real differences between the two are density, mass, melting points, and price, with palladium being the cheaper of the two.

Surgical instrument metals

Hopefully, this article has given you some idea of the different types of metal used to make surgical instruments and their properties.

As you have seen, the different varieties of stainless steel are the most popular as they are relatively cheap, plentiful, and practical for most applications.

Titanium is the next most common, as it has additional strength and is ideal for orthopaedic implants due to the fact it fuses easily with bone.

Tantalum's properties make it an ideal choice to use in surgical instruments.

Finally, there are the precious metals, platinum, and palladium. These are the most expensive, which is why they are rarely used in a medical setting, but they are ideal for small, precision implements and parts.