

We have four metals used in most Smith & Nephew implant components. The materials are: Cobalt-Chromium Alloy (Co-Cr-Mo; ASTM F-1537), Titanium Alloy (Ti-6Al-4V; ASTM F-1472), 316L Stainless Steel (ASTM F-138), and Zirconium Alloy (Zr-2.5Nb; ASTM F-2384). Chemistry limits (in weight percent) for the metals meet these specifications as follows:

Cobalt-Chrome Alloy (Co-Cr-Mo)

Carbon	0.14 max
Chromium	26.0 – 30.0
Molybdenum	5.0 – 7.0
Nickel	1.0 max
Iron	0.75 max
Silicon	1.0 max
Manganese	1.0 max
Nitrogen	0.25 max
Cobalt	Balance

Titanium (Ti-Alloy)

Nitrogen	0.05 max
Carbon	0.08 max
Hydrogen	0.015 max
Iron	0.30 max
Oxygen	0.20 max
Aluminum	5.5 – 6.75
Vanadium	3.5 – 4.5
Yttrium	0.005 max
Titanium	Balance

316L Stainless Steel

Carbon	0.030 max
Manganese	2.00 max
Phosphorus	0.025 max
Sulfur	0.010 max
Silicon	0.75 max
Chromium	17.00 – 19.00
Nickel	13.00 – 15.00
Molybdenum	2.25 – 3.00
Nitrogen	0.10 max
Copper	0.50 max
Iron	Balance

Zirconium Alloy (Zr-Alloy)

Niobium	2.40 – 2.80
Oxygen	0.09 – 0.13
Carbon	0.027 max
Chromium	0.020 max
Hafnium	0.010 max
Hydrogen	0.0025 max
Iron	0.15 max
Nitrogen	0.0080 max
Tin	0.0050 max
Zirconium	Balance

The content of elements specified with a maximum limit are typically about half of that limit in our material. Some elements are controlled more tightly by Smith & Nephew specification than are listed above for the industry standards. For example, our Zirconium Alloy has a maximum limit for Nickel content of 0.0035% (it is difficult to measure Nickel content if it is lower than this). Elements not listed for an alloy are not absent, just not specified. Some level of "tramp element" content is present in any alloy. For Titanium Alloy, the limit in the aerospace industry for each of these "unspecified" elements, including nickel, is 0.10%. The aerospace industry requires so much more Titanium Alloy than the medical industry that the metal suppliers also make the medical alloy to this limit (to minimize inventory). These levels are so low that Titanium Alloy is typically considered "hypo-allergenic" (unless the patient has a Titanium allergy). The same is true of Zirconium Alloy.

We regret that we are unable to provide samples of these metals at this time. If you have any further questions, please call the Materials Quality Laboratory at (800) 821-5700, Ext. 5875 or 5400.