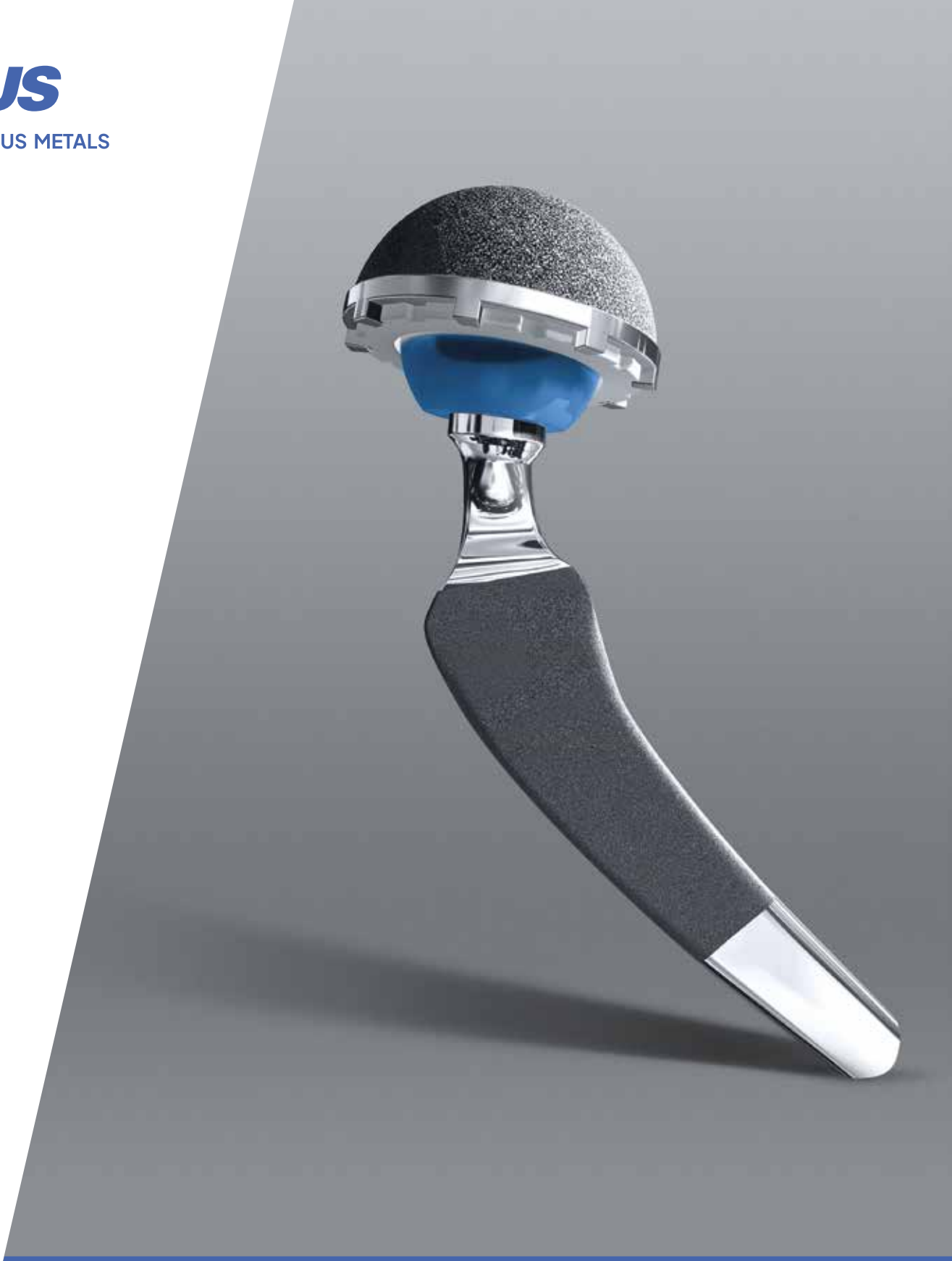
BIBUS

BIBUS METALS



MEDICAL APPLICATIONS

ALLOYS FOR DENTAL AND MEDICAL APPLICATIONS

Titanium is a natural choice for dental and medical implant applications as it is considered non-toxic and biocompatibility, immune to corrosion by the fluids in the body and has a high strength-to-weight ratio and good fatigue properties. Titanium is also non-ferromagnetic meaning that people with titanium implants can still use magnetic medical devices such as MRIs.

The use of titanium and its alloys for dental and medical implants and instruments began in the 1940s. Dental devices such as implants, bridges, crowns and prosthesis components such as screws are made of the commercially pure (CP) **Titanium grades 1, 2 and 4**. The CP grades have good strength and corrosion resistance and are highly formable. Titanium grade 4 is the strongest of the unalloyed grades. Dental implants that interface with the bone of the skull or jaw and facial prosthesis specifically require CP titanium grades. Special stainless steels such as **316LVM** are also used for bone screws and some dental implants.

The use of titanium in hip and knees replacements is well known and demand continues to increase as people are more physically active in later life. Complex reconstructive surgeries following serious road traffic and other accidents is possible due to the high strength and biocompatibility of titanium and its alloys. **Ti-6Al-4V (Gr5) and Ti-6Al-4V ELI (Gr23)** which is a higher purity grade of Ti-6Al-4V with lower oxygen, carbon and iron contents for improved ductility and fracture resistance are widely used for medical implants. Another grade routinely used in these applications is **Ti-6Al-7Nb** where niobium provides strength comparable to Ti-6Al-4V ELI but with improved biocompatibility. These grades are used in the medical device industry for orthopaedic applications such as hip and knee joint replacement systems, fracture fixation plates and screws and spinal devices and fixation systems. They are also used for external prostheses such as artificial limbs and both temporary and long-term external fixations and orthotic callipers due to their high strength-to-weight ratio and toughness.

Titanium is non-magnetic and is regularly used in cardiovascular devices for pacemaker cases, lead wires and for vascular stents. Titanium can be anodised to produce a non-reflective surface which is a useful characteristic for use in surgical instruments as it prevents glare under operating lights. It is durable and can withstand repeated sterilisation treatment without degrading the surface condition and retaining the sharp edge.

The unique properties of titanium and its alloys will allow for future development of bioactive implants, prostheses and instrumentation.

Alloy Properties

	Composition (%)	Key attributes
Titanium Gr. 1 3.7025	Commercially pure	The CP titanium grades have excellent corrosion resistance combined with good ductility and are highly formable. They find application as dental implants, bridges, crowns, orthodontic anchors and screws. They are also used for maxillofacial and craniofacial implants and have allowed for unprecedented advances in reconstructive surgery
Titanium Gr. 2 3.7035	Commercially pure	
Titanium Gr. 4 3.7065	Commercially pure	
Titanium Gr. 5 (Ti-6Al-4V) 3.7165	90Ti – 6Al – 4V	High strength and fatigue resistance with excellent corrosion resistance
Titanium Gr. 23 (Ti-6Al-4V ELI)	90Ti – 6Al – 4V – 0.08O – 0.25Fe	Tight control of interstitial elements C, O and N – high purity for maximum biocompatibility and improved ductility and toughness
Titanium 6Al-7Nb	87Ti – 6Al – 7Nb	The replacement of V with Nb provides strength comparable strength to Ti-6-4ELI with improved biocompatibility
316 LVM 1.4441	18Cr – 14Ni – 3Mo – Fe bal	Low C and vacuum melted to achieve high levels of purity, cleanliness and superior surface finish. Excellent resistance to corrosion