



PRECIOUS METALS



NITINOL



ALLOYS



MICROMACHINING



Johnson Matthey

Brilliant Metals. Precision Manufacturing. Global Supply.

## A History of Leadership and Precise Performance

With more than 180 years of metallurgical development experience, and a global presence, Johnson Matthey holds the trust of medical device OEMs and manufacturers worldwide in the quality fabrication of component parts.

Offering the broadest, most complete range of capabilities in the fabrication of precious metals and alloys, nitinol or engineered plastics, Johnson Matthey strives to be your single source for quality medical device components. Our comprehensive product line includes tube, wire, sheet and micro-machined parts. We use the most-advanced manufacturing processes including EDM, laser cutting, grinding and milling...everything from cut tubing and wire to Nitinol components, micro-machined parts and powder & sputter coatings.

With 4 worldwide manufacturing plants, we have the capacity to meet high-volume demands from the largest medical device manufacturers. And our solid financial strength allows us to quickly ramp-up when you are ready to move your design into full production.

### Summary of Capabilities

Form					Manufacturing Method			
Material	Tube	Wire	Sheet	Micro-Machining	EDM	Laser Cut/Weld	Grinding	Milling/Turning
Precious Metals	X	X	X	X	X	X		
Nitinol	X	X	X	X	X	X	X	
Alloys				X	X	X	X	X
Machined Plastics				X				X

### Metals and Alloys

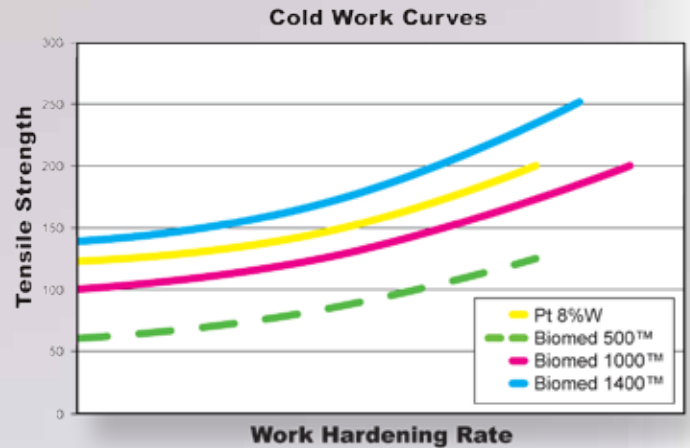
- Platinum
- Platinum Iridium Alloys
- Platinum 10% Nickel
- Platinum 8% Tungsten
- Karat Golds
- Silver
- Rhodium
- Titanium and Titanium Alloys
- Tungsten
- Cobalt Alloys - MP35N™, L605™
- Stainless Steel 303/304/316
- Nickel Titanium (Nitinol)
- Biomed™ Series



## Biomed™ Series Platinum-substitution Alloy Low Cost Radiopaque Wire

Our Biomed wire, sheet and tubing is designed for medical device applications requiring radiopacity. The new alloy uses Palladium and Rhenium to provide high strength radiopaque metal at 80% lower cost than Platinum wire.

The Biomed Pd/Re alloy has all the mechanical properties of Platinum 8% Tungsten at a fraction of the cost. Typical uses may include pacemaker throughwires and coiling applications such as guidewire tips and aneurism coils. All alloy compositions are available annealed, as-drawn or as-drawn and stress-relieved.



\*Information furnished by [www.platinum.matthey.com](http://www.platinum.matthey.com)

Biomed™ Series Alloy will provide the same mechanical and physical properties of Platinum-based materials.

Product Name	Form	Feature
Biomed 500	Pd/5%Re	improved as-cast hardness and wear resistance
Biomed 1000	Pd/10%Re	general purpose medical component applications
Biomed 1400	Pd/14%Re	higher strength for medical components
Biomed Alloy Form	Available Sizes	
Tubing	Refer to specifications on page 5	
Wire	0.0015"(0.0381mm) or greater	
Sheet	Thickness: 0.002"(0.0508mm) or greater	

## Precious Metals

Precious metals, particularly Platinum, are characterized by their high temperature melting points, resistance to corrosion, electrical conductivity and biocompatibility. As a result, Platinum and its alloys are finding increasing use in medical implant applications.

Johnson Matthey is the leading supplier of Precious Metal tube and components for medical device applications. We use advanced melting, extrusion and wire and tube-drawing processes to provide a vertically-integrated process to solve our customer's complex challenges. We offer the largest inventory, range of sizes and selection of alloys in the industry, and JM is your primary source for thin-walled precious metal tubing.

### Applications

Radiopaque markers  
Electrode tips and rings  
Tip coils  
Feed-thru's  
Pacemakers  
Defibrillators

### Precious Metals

Platinum & Platinum alloys  
Platinum / 10% Iridium  
Platinum / 20% Iridium  
Platinum / 25% Iridium  
Platinum 8% Tungsten  
Karat Golds  
Silver



### Rod, Wire and Ribbon

Our metallurgical expertise and fine-wire process controls ensure consistent metallic grain structure in all rod, wire and ribbon for reliable tensile strength and exceptional repeatability. Johnson Matthey rod and wire are available in diameters ranging from 0.125" down to 0.001" — with dimensional consistency assured by laser measurement.

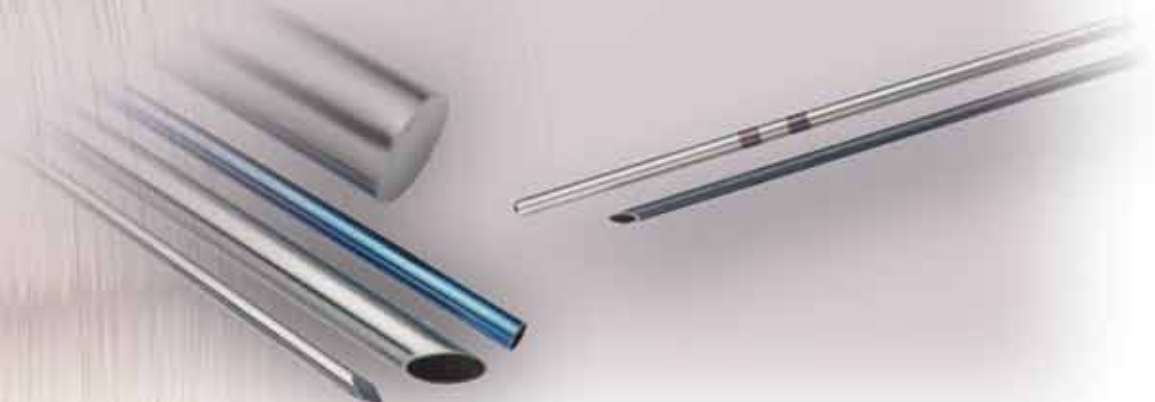
Ribbon, continuous strips of rolled wire, is available in a variety of Platinum alloys. Ribbon is often used in place of round wire to produce coils with minimum outside diameter.

### Specifications

Diameters  
Cut lengths

### Available Sizes

from 0.001"(0.0254mm) to 0.125"(3.175mm)  
0.02"(0.508mm) or greater



## Sheet & Foil

Our unique manufacturing processes allow us to shape, form and roll sheet and foil to extreme dimensions. We offer the broadest range of forms, metals and dimensions to meet any challenge.



### Specifications

Thickness  
Width

### Available Sizes

as small as 0.0007"(0.018mm)  
1.0"(25.4mm) to 3.75"(95.3mm)

## Cut or Slit Tubing, Marker Bands & Ring Electrodes

Seamless tubing for radiopaque marker bands and other applications conforms to stringent dimensional tolerances and quality standards.

- All melts are analyzed using Spark Ablation ICP to measure alloy and impurity concentrations.
- Cutting processes include Electrical Discharge Machining (EDM), CNC Screw Machining, Precision Laser Cutting, Tube Cutting and other processes.
- Certificate of Analysis (COA) and Certificate of Conformance (COC) accompany each shipment.
- Marker band shipments include statistical process analysis documentation.
- Stocking programs available to provide fast response to any demand.

### Specifications

Inside Diameter

### Available Sizes

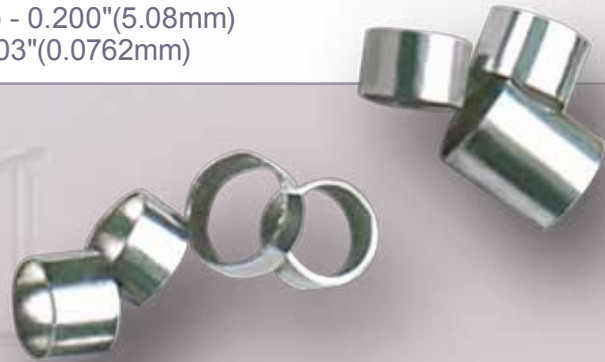
0.0045"(0.1143mm) - 0.250"(6.35mm)  
(tolerance:  $\pm 0.0005$ "(0.0127mm))

Wall Thickness

0.001"(0.0254mm) - 0.005"(0.127mm)  
(tolerance:  $\pm 0.0005$ "(0.0127mm))

Length

0.015"(0.381mm) - 0.200"(5.08mm)  
(tolerance:  $\pm 0.003$ "(0.0762mm))



## Nitinol

Nickel Titanium (also known as Nitinol) is in the unique class of shape memory materials. A thermoelastic martensitic phase transformation in the material is responsible for its extraordinary properties. These properties include the shape memory effect, superelasticity, and high damping capability. The properties of Nitinol can be modified to a great extent by changes in composition, mechanical working, and heat treatment.

Johnson Matthey has accumulated over 20 years of specialized Nitinol research that gives us the expertise to exploit Nitinol's properties to design the product for your medical devices. We specialize in high volume applications where we can implement automated processes to produce your component at minimal costs. And, we develop the custom fixtures to provide efficient shape setting of the final design.

### Applications

Stents	Distal protection
Catheter shafts	Laparoscopes
Orthodontic guidewires	Retrievers
Endoscopic guide tubes	Occluders
Valve frames	Needles



### Form

### Available Sizes

### Surfaces

Tubing	O.D.: 0.008"(0.203mm) to 0.400"(10.16mm) Wall thickness to 0.002"(0.05mm)	natural oxide, etched OD/ID, centerless ground, mechanically-cleaned ID
Wire	Diameters from 0.012"(0.3048mm) to 0.250"(6.35mm)	black oxide, amber/brown oxide, natural oxide polished, etched, centerless ground
Sheet	Thicknesses from 0.002"(0.051mm) to 0.080"(2.03mm) Width to 6.00"(152.4mm)	natural oxide, etched
Foil	Thicknesses from 0.0007"(0.0127 mm) to 0.002"(0.051mm) Width to 3.00"(76.2mm)	natural oxide, etched
Micro-machined Components	<i>Consult us for complete capabilities</i>	



### General Specifications

Complies with the following ASTM Standards: F2004-05, F2005-05, F2063-05, F2082-02, F2516-05, F2633-07

Available in superelastic or shape memory form - Transformation Temperatures from 0°C to 100°C

Thermomechanical conditions: As Cold Worked, Straight Annealed, Flat Annealed, or Shape Set Annealed

Typical Certification includes: Transformation Temperature, Tensile Properties, and Chemical Composition

## Tubing

Johnson Matthey is a leader in large diameter, thin wall, and microlumen Nitinol tubing. The overall length of the tubing is a function of outside diameter. For most applications, the wall thickness should be greater than 10 percent of the outer diameter to avoid buckling. Applications include laser cut stents, endoscopic guide tubes, and distal protection devices.

## Wire

Wire is the most mature product form of Nitinol, being commercialized in the mid 1980's. Applications include guidewires, support members in a catheter wall, and wire wound stent fabrication.

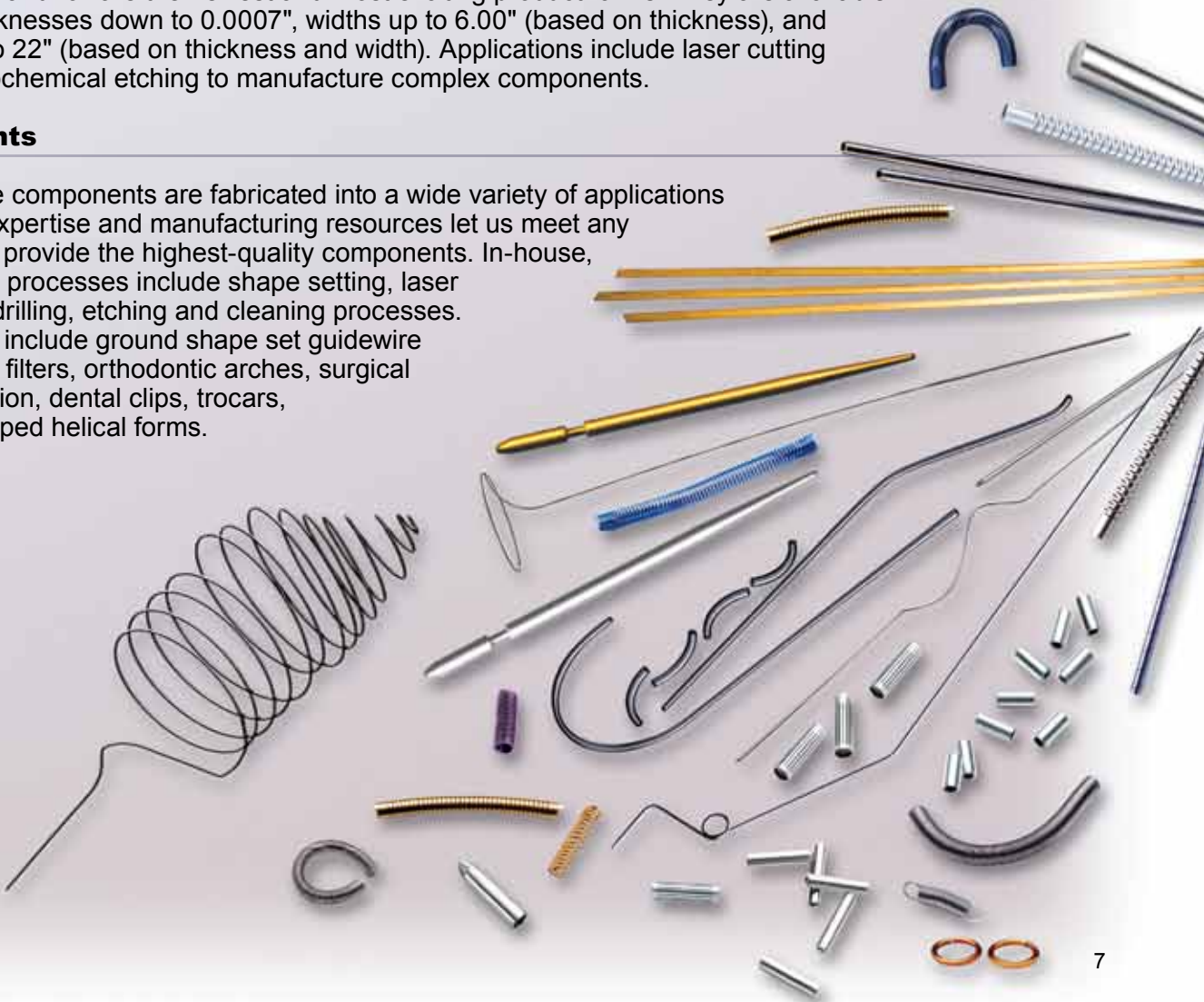
**NiTiBrite™ Nitinol Wire** has an improved, bright, oxide-free surface. The brilliant finish is accomplished using our new process to remove the oxide layer usually associated with the processing of Nitinol wire. This process leaves no harmful residues and is free from Hydrogen embrittlement. Diameters are available from 0.018" to 0.040" in continuous spooled lengths.

## Sheet and Foil

Nitinol sheet and foil are the newest and most exciting product forms. They are available in rolled thicknesses down to 0.0007", widths up to 6.00" (based on thickness), and lengths up to 22" (based on thickness and width). Applications include laser cutting and/or photochemical etching to manufacture complex components.

## Components

Many unique components are fabricated into a wide variety of applications today. Our expertise and manufacturing resources let us meet any challenge to provide the highest-quality components. In-house, value-added processes include shape setting, laser cutting and drilling, etching and cleaning processes. Applications include ground shape set guidewire cores, blood filters, orthodontic arches, surgical instrumentation, dental clips, trocars, and 3-D shaped helical forms.



# Precision Micromachined Components

Micro-machining is a key enabling technology for medical components. Our production floor is filled with precision CNC Swiss Screw Machines operated by trained specialists to produce the highest quality, micro-machined parts for medical applications. Our development cell is ready to produce your first articles for approval. And, machinery is identical in the development and production areas to allow for easy transfer to full-line production.

## Applications

- Catheter shafts
- Guidewires
- Cleanroom fixturing
- Orthopedic
- Cardiac implants
- Hypotubes
- Precision pins, tips and rollers
- Bushings, shafts, shims and spacers
- Precision fixtures and assembly tools



## Materials

### Precious Metals

- Platinum & Platinum alloys
- Platinum/ 10% Iridium
- Platinum/ 20% Iridium
- Platinum/ 25% Iridium
- Karat Golds
- Silver
- Biomed™ Series



### Other Alloys

- Nitinol
- Cobalt alloys - MP35N™ & L605™
- Stainless Steel 303/304/316
- Titanium & Titanium alloys
- Tantalum
- Aluminum
- Brass
- Copper
- Kovar



## Capabilities

Feature	Minimum	Maximum	Tolerance
Burr		0.0005"	
Edge Break	0.002"	0.005"	
Corner Radius	0.002"	0.005"	
Fillet	0.002"	0.005"	
Concentricity			± 0.001 TIP
Angles			± 1 deg.

## Finish

Outside Surface	8 micro inch	63 micro inch	"or better"
Inside Surface	16 micro inch	63 micro inch	"or better"

## Services

3- to 12- axis machining	TiN sputter coating
7-axis screw machines and turning centers	Powder coatings
Heat treating	Laser cutting and welding
Machining depths to 10x the ID	





## Wire EDM and Sinker EDM

Wire and Sinker EDM produces exceptionally precise, complex burr-free shapes made from sheet, tube, wire. The machines provide efficient and low-cost solutions in many applications, allowing customers to design parts for optimum function without the typical restrictions of other metalworking processes.

- Surface finish to Ra 16 $\mu$  in. (0.4 $\mu$ m)
- Inside corner radiuses down to 0.002"(0.051mm)
- Cut widths down to 0.003"(0.075mm)
- Tolerances down to  $\pm$  0.0002"(0.005mm)

## Centerless and Profile Grinding

Our precision grinding operations are used for diameter reduction, tapers and shoulder creation on tube and wire components.

- Diameters to 0.005"(0.127mm)
- Tolerances  $\pm$  0.0002"(0.005mm)

## CNC Surface Grinding

We use a low-force process to grind a variety of materials for flatness, parallelism, close tolerance dimensions and surface finish.

- Thickness to 0.08"(2.032mm)
- Tolerances  $\pm$  0.0001"(0.025mm)



## Milling and Turning

Milling makes complex profiles on block-style metal parts. Turning provides similar capabilities on cylindrical parts. Our experienced machinists will face, square, drill, thread, bore or slot parts with the highest levels of precision and repeatability.

- Part sizes down to 0.010"(0.254mm)
- Hole drilling to 0.002"(0.051mm)
- Tolerances to  $\pm$  0.0002"(0.005mm)

## Coating and Electroplating

Coating or electroplating may be necessary when the innate characteristics of two different materials are required. For example, gold plating can be added to stainless steel for increased conductivity. A PTFE coating can be added for friction reduction using its natural lubricating qualities. We offer a variety of processes for rod, wire and hypotubes.

- Gold plating
- Parylene
- Nickel anodizing
- Electropolish
- PTFE coatings
- Passivation



## Hypotubes

Hypotubes are stainless steel tubes that act as the foundation of a catheter shaft. Hypotube-based shafts offer superior performance during minimally invasive procedures due to their superior push, trackability and torque. We precision-cut and grind hypotubes with incredible accuracy.

We also offer skiving steps to add cuts on the hypotube and flaring to open the end of tube.

## Precision Machined Plastics

We have applied our extensive metal machining expertise to machining processes for plastics. Our tolerances to 0.0005" for CNC milling and turning processes provide the precision you need. We can also Centerless grind many plastics to even tighter tolerances. The use of water-based coolants and ultrasonic DI water cleaning assures the highest cleanliness.

Our specialized 7-axis turning centers combine multiple machining steps to produce completed parts in one process. This time-saving equipment helps reduce costs for finished parts.

### Applications

Catheters  
Mandrels  
Cleanroom fixturing  
Orthopedic  
Cardiac implants  
Precision pins, tips and rollers  
Bushings, shafts, shims and spacers  
Precision fixtures and assembly tools

### Materials

Noryl  
Delrin  
Ultern  
PTFE  
Polycarbonate  
Torion  
Vespel  
ABS  
PEEK



### Capabilities

Part sizes down to 0.1"(2.5mm)  
Hole drilling to 0.012"(0.305mm)  
Tolerances to  $\pm 0.0005$ "(0.025mm)  
Thickness to 0.08"(2.032mm)  
Diameters to 0.005"(0.127mm)  
Surface finish to 8 rms

## Technical Expertise, High Volume Capacity and the Financial Strength to Make it Happen

Over 180 years of metallurgical expertise

4 key manufacturing sites provide a full range of capabilities

Support for all stages - development, prototype, manufacturing design and volume manufacturing

Complete process control from melting to fabrication, refining and machining

Advanced manufacturing equipment for rolling, forming, drawing and micro-machining

Continuous investment in new equipment to support high volume demand

JIT delivery and customer-dedicated inventories

Dedicated Customer Service Team to provide fast response

### Focus on Quality

Committed to excellence... we ensure the integrity of all our products. From melting through fabrication and refining, we maintain complete control over the entire process to provide you with the highest quality product. All manufacturing locations use dedicated quality control instruments and processes to assure compliance with customer specifications.

- ISO 9001 and 14001 certification emphasizes continuous improvement, customer satisfaction, and high quality standards
- RoHS and WEEE Compliance with EU Directives for Restriction on the use of certain Hazardous Substances and Waste Electrical and Electronic Equipment
- REACH Compliance with EU Regulations regarding Registration, Evaluation and Authorization of Chemicals
- Full Statistical Process Control systems and customized documentation ensure process control, consistency, and product repeatability. Expert analytical capabilities - like spectrographic analysis at melt stage - ensure uniform product consistency and reliability
- Laser measurement, EDAX, and scanning electron microscopes ensure that all wire products meet the component specifications for diametric tolerance and surface finish
- ICAP (Inductively Coupled Argon Plasma Spectroscopy) speeds the process of chemical composition analysis
- JM participates in ASTM E691 Round Robin Testing and offers optional GDMS (Glow Discharge Mass Spectrometry) chemical analysis
- Foil products are manufactured to provide artifact-free imaging
- Advanced receipt & weigh scale system and metal source documentation ensure melt, lot, and part traceability for every shipment
- JM is a proponent of the 6 Sigma Program for superior quality standards





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