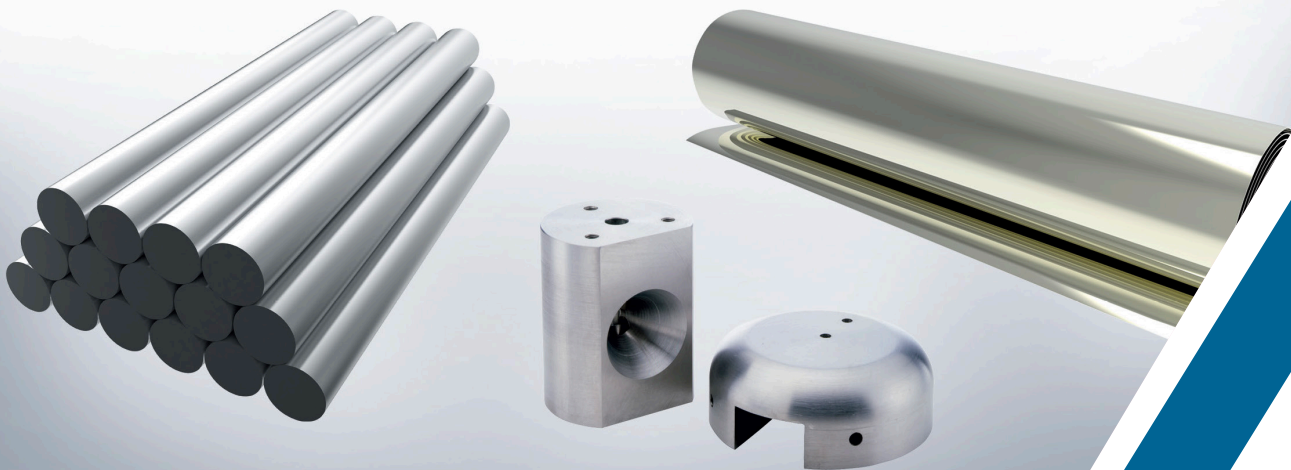
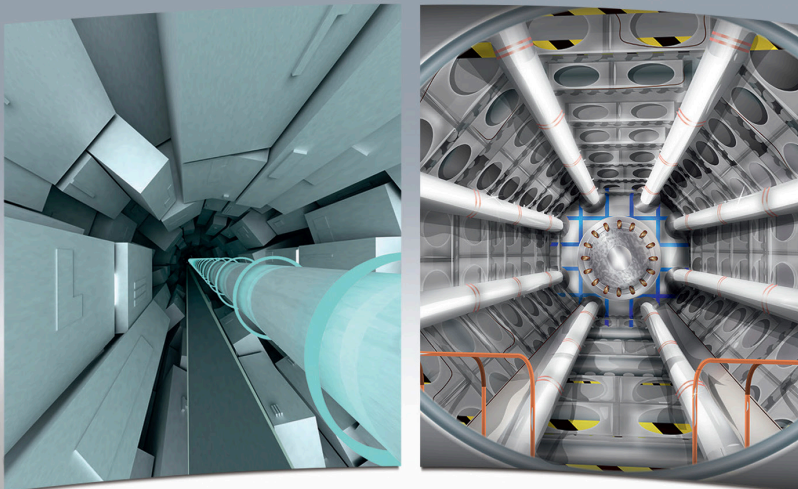


# ACCELERATING INTO THE FUTURE WITH REFRACTORY METALS



## TECHNOLOGY METALS DESIGNED FOR PARTICLE ACCELERATORS

In high energy projects like particle physics, particle accelerators are used to speed up and collide sub-atomic particles like protons or electrons to break them into smaller, fundamental particles. The short-lived particles are detected and then analyzed to determine how they interact with each other with the ultimate goal of understanding the physical laws of the universe.

As an example, inside the Large Hadron Collider (LHC), the world's largest and most powerful particle accelerator, two high-energy beams of protons travel close to the speed of light in opposite directions. These particle beams are guided around an accelerator ring by a strong magnetic field generated by superconducting electromagnets before they collide within sophisticated detectors.

Elmet Technologies' tungsten (W) alloys are used as beam collimators and shields, while Elmet Technologies' niobium (Nb) metal has unique properties that make it a primary choice for superconducting material to create the electromagnetic fields that steer and propel the charged particles to very high speeds. In addition, Elmet Technologies offers extrusion services for extruding large diameter superconducting wire bundles.

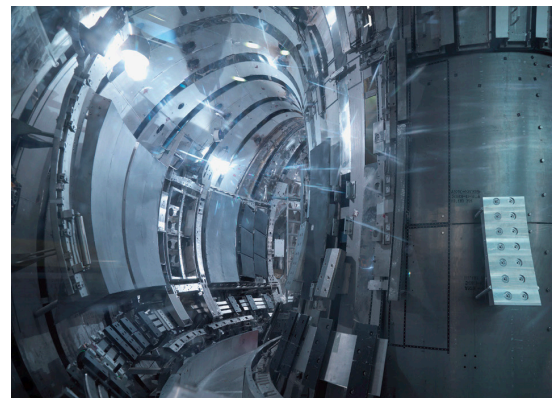
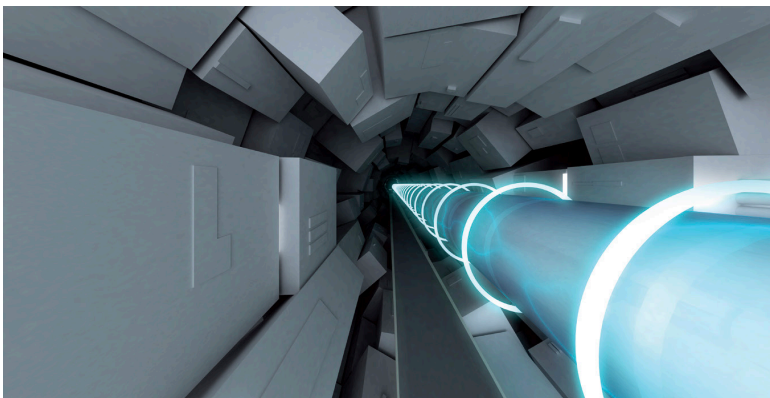
### Applications

- > MRI and NMR medical equipment
- > Mass spectroscopy
- > Nuclear fusion research equipment>
- > Magnetic levitation
- > Particle accelerators
- > Superconductors
- > Beam Blockers
- > Targets
- > Shielding Blocks
- > RF Cavities and Supporting Parts
- > Calorimeters

### W, Nb Products

- > Sheet
- > Tube
- > Plate
- > Fabricated Parts
- > Bar

Elmet Technologies has supplied fabricated products including tungsten slugs used in the FCAL Section of the Atlas Detector of the Large Hadron Collider (LHC).



## TECHNOLOGY METALS DESIGNED FOR PARTICLE ACCELERATORS

Elmet Technologies' outstanding material properties provide shielding from radiation along with other highly desirable characteristics.

### Tungsten High Density Alloys

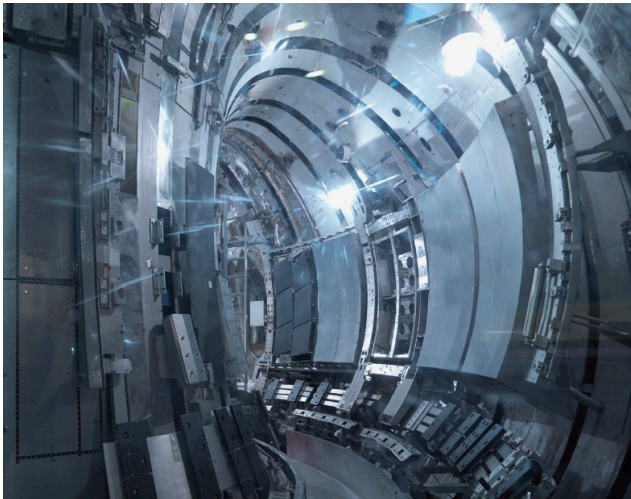
- > High Density
- > High Strength
- > Excellent Machinability
- > High Melting Point

### Tungsten High Density Alloys

- > Low Temperature Superconductivity (low resistivity)

PROPERTY DATA FOR PURE METALS*		NIObIUM	TUNGSTEN
Property	Atomic Number Atomic Weight Lattice Type	41 92.91 bcc	74 183.86 bcc
Mass	Density at 20 °C gm/cc	8.57	19.3
Thermal	Melting Point °C	2468	3410
Properties	Boiling Point °C Linear Coefficient of Expansion per °C Thermal Conductivity at 20 °C, cal/cm2/cm °C/sec Specific Heat cal/g/°C, 20 °C	4927 7.1x10-5 0.523 0.126	5900 4.3x10-6 0.4 0.032
Electrical	Conductivity, %IACS	13.30%	31%
Properties	Resistivity, microohms-cm, 20 °C Temperature Coefficient of Resistivity per °C (0-100 °C)	15 0.00395	5.5 0.0046

\* Metal Alloys also available



### Niobium Rod and Sheet for Superconductors

ASTM B392 (Nb) Compliance

#### Rod Sizes:

- > Diameters: 10 - 130 mm
- > Max. length: 2.5 - 7.5 m

#### Sheet Sizes\*

- > 0.25 - 2.5 mm thick, up to 1m wide

\*Other dimensions available upon request

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