High Performance Alloys

go-to solutions for

demanding applications

MATERION

"When you have exhausted all possibilities, remember this: You haven't."

Thomas Edison understood exactly how technology can play out. Sometimes our biggest, most groundbreaking ideas never see the light of day because we don't have the right tools, resources or insights to bring them to fruition.

Our team at Materion never wants *your* team to be at a disadvantage because they lack suitable materials. Our engineers and metallurgists work tirelessly to develop high performance alloys that meet or exceed the exacting requirements of the latest technologies and innovations. Whether your priority is high strength; superior conductivity; corrosion or wear resistance; or some combination of these properties, Materion provides solutions. Each of our alloys has its own unique property set, so designers and engineers have the flexibility to choose what's most important to the project at hand.

Learn more about Materion's high performance alloys right here. You can also visit Materion.com for more details, including data sheets, for not only these alloys but also our clad metals, metal matrix composites, technical ceramics and more. We'll show you that when it looks like all possibilities have been exhausted, you've only just begun.

Clive Grannum
President

PERFORMANCE MATERIALS




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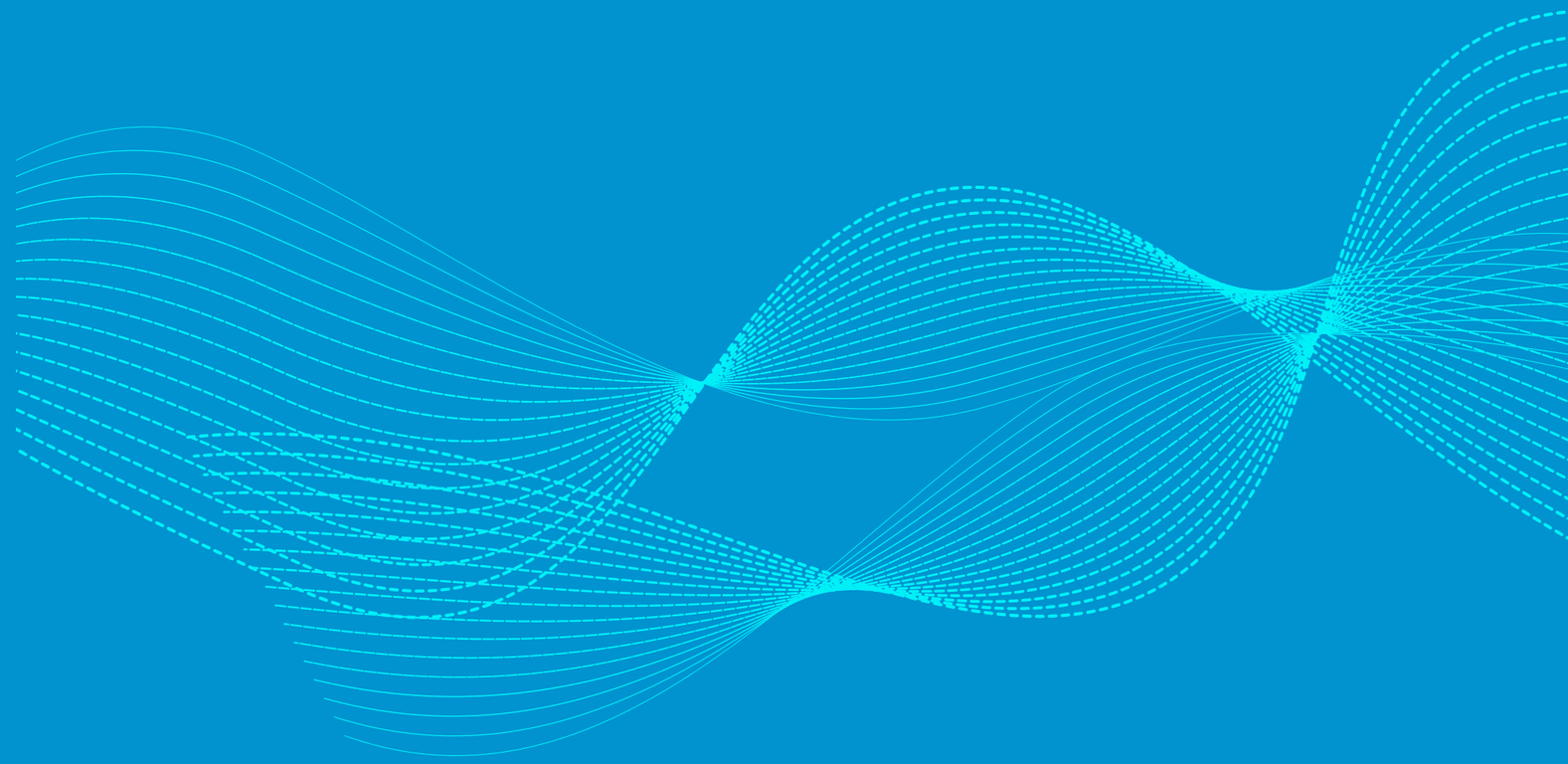
High Performance Alloys

Section 1

As the world keeps getting smarter, Materion continues to anticipate the needs of designers and engineers tasked with bringing next-gen technologies to life. Our materials enable faster, more reliable and increasingly capable connectivity across a sweeping range of consumer electronic, aerospace, telecommunication and automotive applications to satisfy markets today and into the future. Looking toward 6G and beyond, Materion has the vision and expertise to partner with you on solutions that support your most advanced innovations.



Connectivity

Copper Beryllium Alloys

A unique combination of strength, conductivity, hardness and corrosion resistance makes copper beryllium (CuBe) alloys reliable in extreme conditions. With over a dozen CuBe alloys in our product lineup, Materion offers materials exhibiting a broad range of physical and mechanical properties to fulfill a variety of needs.

For example, as connector materials for commercial aircraft, EVs, telecommunication applications and more, CuBe strip, rod and wire products provide:

- The highest strength of all copper-based alloys
- Conductivity for electrical and thermal energy
- Excellent stress relaxation resistance
- Miniaturization without impacting performance
- Good formability for complex shapes

Read about all of Materion's CuBe alloys in Section 5, Copper Beryllium Alloys

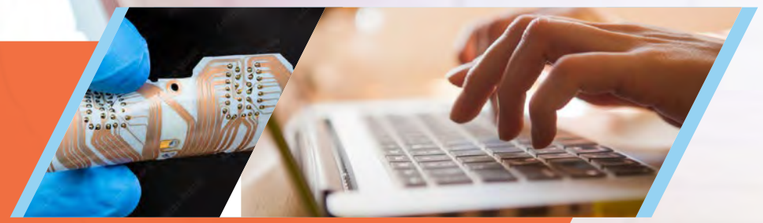
Explore Copper Beryllium Alloys

BrushForm 158 Alloy

Materion's BrushForm® 158 (BF 158) copper nickel tin foil-gauge alloy is ideal for smartphones, tablets, cameras and other devices. Free of beryllium, BF 158 outperforms copper beryllium and copper titanium in applications with high strength and temperature requirements, and offers good corrosion resistance, which is vital for water-resistant devices.

BF 158 strip is engineered to provide optimal formability for voice coil motor and optical image-stabilizing applications in smartphones, in electronic devices. It offers substantially higher strength in foil gauges as thin as 0.001" (0.025 mm) for greater design flexibility.

Explore BrushForm 158 Alloy



QMet Strip Alloy

QMet® 300 strip alloy is a high-performance, heat-treated copper-chromium-silicon alloy that is ideally suited for reliable high-power electrical and electronic connectors for industrial applications. Its conductivity is greater than all other alloys of similar strength. Although free of beryllium, QMet strip features stress relaxation resistance comparable to that of copper beryllium.

QMet 300 strip alloy properties:

- High strength
- High conductivity
- Improved formability
- Stress relaxation resistance

Explore QMet Strip Alloy

Brush 1915 Alloy

Brush 1915® alloy is a leaded nickel copper alloy that provides high strength, high conductivity and good formability.

Its machinability — along with high tensile and yield strength, good stress resistance, excellent cold headability and other properties — makes Brush 1915 a good alternative for copper beryllium alloys used for circular connectors in large vehicles such as trucks and buses.

Explore Brush 1915 Alloy

High Performance Alloys

Section 2

If your work focuses on innovations related to automated, connected, environmentally friendly and boundless travel, ordinary materials simply won't do. Materion has developed extraordinary alloys designed to enable safe, efficient and reliable transportation here on Earth as well as in the far reaches of space.

Advanced Mobility

ToughMet Alloys

As their name suggests, ToughMet® copper nickel tin alloys were designed for harsh environments where fatigue, corrosion, wear and galling are concerns. Engineered to provide attributes that go well beyond those typically found in high-strength copper materials, these alloys have become the material of choice for leading global aerospace and automotive companies.

In commercial aerospace applications, ToughMet alloys provide strength, durability and stability under extreme loads and the range of temperatures experienced during flights. In automotive powertrains, they provide longer life in higher-speed, higher-pressure applications.

ToughMet alloys are nonmagnetic and easily machined. They are available in a range of tempers offering a variety of mechanical properties that ensure they excel in the most demanding applications.

Explore ToughMet Alloys

Niobium Alloy

The rigors of space are no match for the power of C-103 niobium alloy. This high-performance solution is well-suited for rocket and jet propulsion applications in spacecraft and launch vehicles. C-103 niobium alloy also has excellent resistance to high frequency vibrations at cryogenic temperatures that occurs in many satellite applications. It is available in rods, bars, sheets, ingots, slabs, powder and fabricated parts.

Composed of niobium, hafnium and titanium, C-103 niobium provides the following benefits:

- The capability to withstand high stresses at elevated temperatures
- High room-temperature ductility
- Low ductile-to-brittle transition temperature for cryogenic applications (-150˚C)
- Excellent fabricability
- Good weldability

Explore Niobium Alloy

AyontEX Alloys

Challenging operating environments common in aerospace, defense, automotive, electronics and similar applications require materials that can manage heat and provide critical structural properties that match the CTE of nickel and copper. Materion's expanding AyontEX™ family of alloys, which are manufactured through a powder metallurgy method to ensure refined microstructure and unique property sets, are engineered to meet these challenges.

AyontEX 13 and AyontEX 17 are hypereutectic aluminum silicon alloys that are light, strong, stiff, machinable and highly thermally transmissive. When compared with competing materials, these alloys provide the best balance of thermal conductivity and strength, making them ideal for structural heatsinks. They offer the robustness to hold electronic components in weight-sensitive thermal management applications.

AyontEX 4632 (previously known as AMC® 4632) alloy meets even higher strength, temperature and fatigue endurance requirements than other AyontEX alloys. In automotive racing piston applications, it can replace conventional aluminum alloys, enabling weight reduction and improved stability despite the high temperatures associated with internal combustion engines.

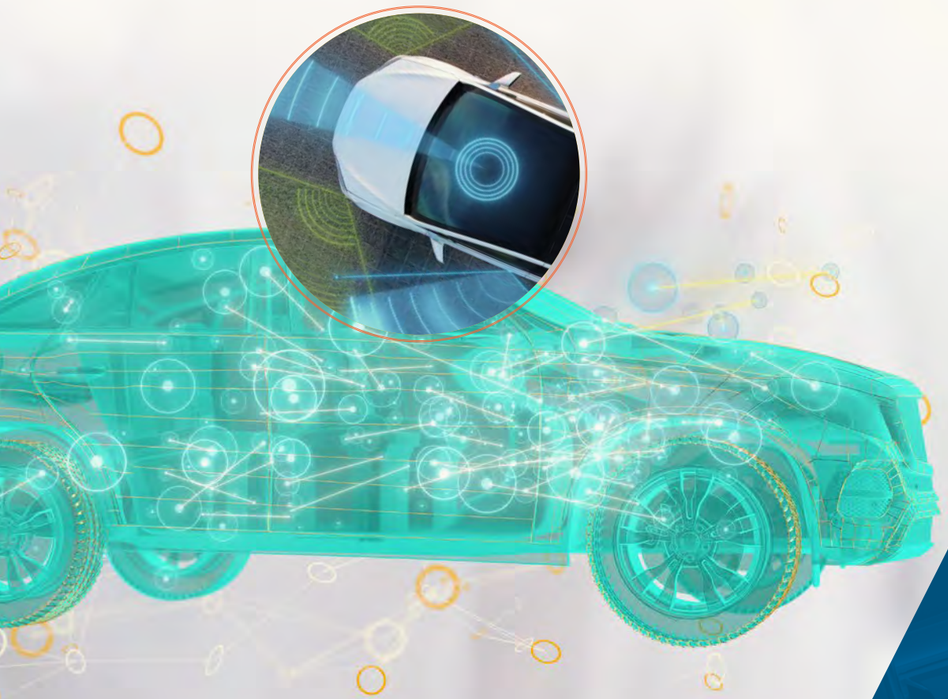
Explore AyontEX Alloys

Copper Beryllium Alloys

Extreme conditions call for extraordinary alloys. Materion offers an expanded line of CuBe alloys in a variety of forms — rod, bar, wire, tube, plate, strip, forgings and extrusions — that are ideal for advanced mobility applications. Whether you're looking for solutions for electric and autonomous vehicles, next-generation powertrain vehicles, commercial and military aircraft and spacecraft, or other applications, Materion's CuBe alloys are up to the task. Each alloy provides the kind of superior strength, conductivity, hardness and corrosion resistance you need in demanding environments.

Read about all of Materion's CuBe alloys in Section 5, Copper Beryllium Alloys

Explore Copper Beryllium Alloys



PerforMet Alloy

On the racetrack or the highway, in EVs and gas-fueled vehicles, PerforMet® alloy delivers enhanced engine efficiency, higher performance and long-term reliability. This nickel silicide-strengthened bronze alloy has been optimized for automotive powertrain applications, and withstands higher pressures and temperatures. Available in rod and tube forms, PerforMet outperforms conventional materials by a mile.

PerforMet's properties include:

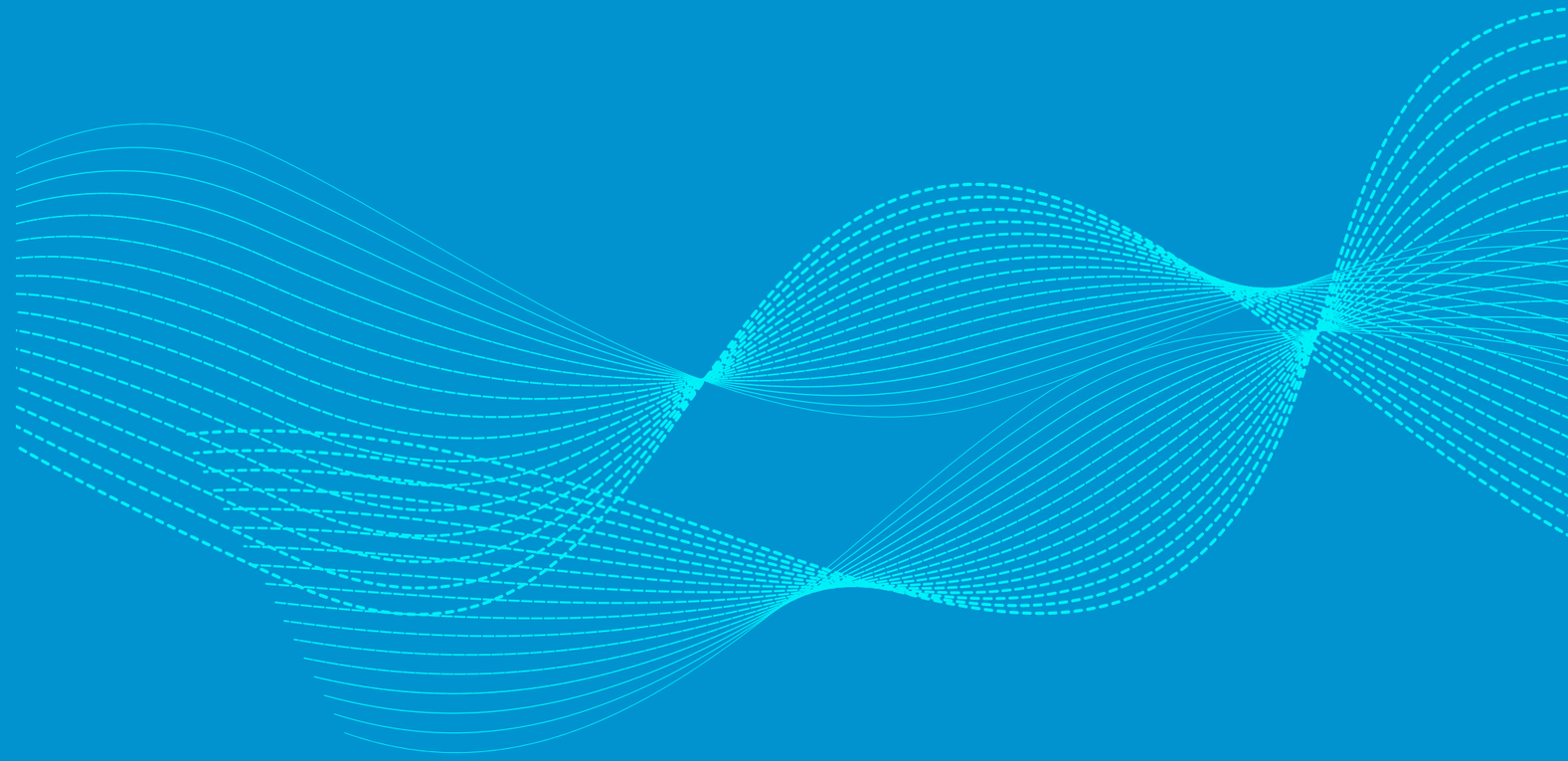
- High conductivity
- High strength at elevated temperatures
- Friction, wear and corrosion resistance
- Good machinability

Explore PerforMet Alloy

High Performance Alloys

Section 3

As the U.S. and other countries strive to reach net-zero emissions by 2050, Materion is committed to doing our part. Our advanced materials are enabling technologies to ensure a more sustainable future, where next-generation energy solutions power environmentally friendly travel and space exploration, and energy-efficient buildings. We also provide energy transition materials that are helping the oil and gas industry move to newer, cleaner production methods.



Clean Energy

ToughMet 3 Alloys

The ongoing global transition to renewable energy — wind, solar, geothermal, hydropower, biomass and others — challenges engineers to not only design new, state-of-the art equipment but also modernize equipment used in more conventional energy environments, such as oil and gas drilling sites. ToughMet® 3 copper nickel tin alloys stand up to all of these demanding energy applications.

Available in plate, rod, bar and tube forms, these spinodally hardened, high-performance alloys ensure the utmost in reliability, strength and durability in high-temperature, high-pressure environments. They are an ideal choice in circumstances where equipment malfunctions or failures could result in severe economic or environmental consequences.

ToughMet 3 alloys provide attributes beyond those typically found in high-strength copper alloys, including:

- Tensile and fatigue strength, even at elevated temperatures
- Corrosion, erosion and wear resistance
- Control fluid compatibility
- Magnetic transparency
- Anti-friction and anti-galling characteristics
- Excellent machinability

Explore ToughMet Alloys

High Performance Alloys

Section 4

From plastics manufacturing and construction to mining, medicine and beyond, engineers are overcoming the most difficult challenges by selecting Materion alloys. Formulated to excel under intense and exacting conditions, these extraordinary materials help companies keep pace with industry breakthroughs and continual improvement, no matter how demanding those advances may be.

Advancing Industries

ULTRA 76 Plus Tantalum Alloy

ULTRA 76 Plus tantalum alloy supports a broad range of markets and applications that can benefit from the unique properties of tantalum, one of the rarest elements on earth. Compared with titanium, nickel, zirconium or steels, ULTRA 76 Plus offers higher strength and superior corrosion resistance in hydrochloric and sulfuric acid applications (HCl and H_2SO_4 acids) using higher temperatures and concentrations.

ULTRA 76 Plus tantalum alloy also provides longer equipment life, lower operating downtime and the ability to stand up to increased operating temperatures. It can be an ideal choice for heat exchangers; condensers and coils; thermocouple protection sheaths; paddle stirrers and agitators; distillation columns; crucibles and other applications.

Explore Tantalum Alloy

MoldMAX Alloys

MoldMAX® alloys have set the standard for plastics molding for more than 20 years. These high-performance materials stand up to the relentless demands of injection and blow molding operations with a combination of strength, thermal conductivity and good polishability. Use them in a variety of applications, including core and cavity inserts, sliders and lifters, hot run tips, core pins, ejector sleeves, pinch-offs and more.

Choose MoldMAX HH®, MoldMAX LH®, MoldMAX V®, MoldMAX XL® or PROtherm® alloys when you need:

- Strength and thermal conductivity that improves cycle time and part quality
- Excellent machinability
- Uniform microstructure that resists chipping and pitting
- Corrosion resistance
- Wear and galling resistance

Explore MoldMAX Alloys

ToughMet Alloys

In addition to aerospace, automotive, and oil and gas applications, Materion's ToughMet® cast and wrought alloys can be the right choice in a broad range of industrial applications where bushings and bearings take a beating. ToughMet outperforms steel, bronze and other materials in harsh environments such as surface and underground mining, forestry, construction and manufacturing equipment.

ToughMet alloys last longer, carry more load, require less maintenance and eliminate unplanned equipment repairs. High strength, low friction and resistance to galling, corrosion and wear make them exceptionally reliable and durable. ToughMet 2 CX 90 offers a cost benefit as well: For plain bearing applications, it delivers superior performance at an affordable price.

Explore ToughMet Alloys

Alloy 360

High-reliability electrical and electronic systems, fire protection sprinkler systems, heavy-duty controls, high-pressure/high-temperature connectors, electromechanical devices and other high-performance applications can benefit from the unique mechanical and physical properties of Materion's nickel beryllium strip Alloy 360.

High strength and hardness, excellent formability and corrosion resistance surpassing that of stainless steel are just the start. Alloy 360 also provides high resistance to wear, thermal shock and oxidation, which make this strip alloy an ideal choice for high-temperature environments like thermostats, bellows, diaphragms, burn-in contacts and Belleville washers used in fire protection sprinkler heads.

Explore Alloy 360

High Performance Alloys

Section 5

Materion manufactures copper beryllium rod, bar, wire, tube, plate, strip, forgings and extrusions in more than a dozen distinct compositions. Each alloy offers its own unique combination of strength, conductivity, hardness and corrosion resistance to enable and enhance your end-use applications.

Copper Beryllium Alloys

Alloys 3, 10, 10X and 310

High electrical and thermal conductivity characterizes this group of Materion alloys. They offer a variety of design options to engineers in the appliance, automotive, oil and gas, industrial, and telecom and server markets. While each alloy has its own unique chemistry and features, all deliver high performance, reliability and durability.

Alloy 3, a copper-nickel-beryllium alloy, combines high conductivity with good elevated temperature strength and stress relaxation resistance. In automotive applications, it is commonly used for valve seats and pre-ignition chambers. In wire form, Alloy 3 works well in long-reach power and signal cables for offshore oil and gas operations. As a strip product, it is a reliable choice for switches and relays. And in plate form, Alloy 3 is ideal for metal die casting, injection molding and blow molding applications.

Download Alloy 3 Data Sheets

Alloy 10 is a copper-cobalt-beryllium alloy that delivers moderate yield strength — up to 140 ksi — with electrical and thermal conductivity that is 45-60% that of pure copper. Like Alloy 3, Alloy 10 is designed for the appliance, automotive, telecom, and oil and gas industries, and is an excellent material for metal die casting, injection molding and blow molding.

Download Alloy 10 Data Sheets

Alloy 10X, a copper-cobalt-beryllium-zirconium alloy, was developed for improved high-temperature strength and ductility. This material retains good strength and ductility at temperatures up to 800°F/430°C, and is exceptionally resistant to thermal cracking. Alloy 10X is the copper alloy of choice for sustained operation when high strength is required above 575°F/300°C. It is ideal for high-performance powertrain automotive applications such as exhaust valve seats and pre-ignition chambers.

Download Alloy 10X Data Sheet

Alloy 310 is a copper-beryllium-nickel-cobalt alloy that adds higher-than-average thermal fatigue resistance to the properties it shares with Alloys 3 and 10: high electrical and thermal conductivity, strength and hardness. This combination of properties makes Alloy 310 suitable for resistance welding electrodes, welding electrode components, nonferrous metal casting, dies, nozzles and plungers.

Download Alloy 310 Data Sheet

Alloys 25, M25 and 165

This group of high-strength copper beryllium alloys has what it takes to perform under grueling conditions in a broad range of industries: aerospace, automotive, consumer electronics, industrial, energy, telecom, etc. Turn to Alloys 25, M25 and 165 in applications that require high conductivity, fatigue strength, and resistance to wear, corrosion and galling.

Alloy 25 is a versatile material that provides not only the highest strength of any CuBe alloy, but also electrical and thermal conductivity that is considerably greater than other high-strength copper alloys. Alloy 25's ultimate tensile strength can exceed 200 ksi (1380 MPa) and hardness approaches HRC 45. It is available in rod, tube, plate, bar, strip, wire, forgings and extrusions. Applications include drilling components for oil and gas; computer processor socket contacts and electromagnetic shielding gaskets in consumer electronics; pressure sensor bellows, and burn-in and test socket contacts in industrial settings; and cable, board-to-board and other miniature connectors in the medical industry.

Download Alloy 25 Data Sheets

Alloy M25 is highly machinable due to the addition of lead. Available in rod and wire forms, it is a multipurpose solution for aerospace, automotive, consumer electronics, industrial, energy, telecom and other applications. For example, Alloy M25 is well-suited for contacts in aircraft, automotive and electronics applications, and for push-pull, circular, nonmagnetic RF, I/O and other miniature connectors in the medical market. It can also be machined into parts for the watch industry, contacts for circular connectors and coaxial connectors.

Download Alloy M25 Data Sheets

Alloy 165 provides strength nearly as high as Alloy 25, but with a slightly lower beryllium content. It is available in a variety of forms: rod and bar to make bushings, bearings and resistance welding components; tube for telecom applications including undersea instrument housings and repeater housings; and plate for wear plates and resistance welding components.

Download Alloy 165 Data Sheets

Alloy 174 and Brush 60® Alloy

As components become smaller and signal requirements become more stringent, selecting the right connector material is increasingly important. Alloy 174 and Brush 60 provide design flexibility, ease of manufacturing and life cycle reliability. When compared with conventional alloys, these advanced, mill-hardened materials provide five times the electrical conductivity, superior resistance to stress relaxation and an excellent combination of elastic modulus, strength and formability. Originally designed for the automotive and telecom industries, Alloy 174 and Brush 60 possess unique property combinations that have made them successful solutions across all industries that require electric connections — oil and gas, aerospace, consumer electronics and more.

Alloy 174 features twice the electrical conductivity of brass, has a high repetitive cycle life and is easily formed into complex shapes. It is available with tin coatings or precious metal inlays. Even when miniaturized, Alloy 174 maintains the spring force to provide a reliable contact. It is used for automotive terminals, spring contacts for switches and relays, and connectors for appliances and consumer electronics.

Download Alloy 174 Data Sheet

Brush 60 alloy strip is a high-performance, lower-priced CuBe alloy engineered to meet demanding electronic and mechanical connector requirements in telecom, consumer electronics and computing applications. It exhibits outstanding stress relaxation resistance and can retain a higher normal force over the life of the connector. Brush 60 helps improve signal transfer through greater contact force and conductivity, provides superior high-temperature durability and is completely recyclable.

Download Brush 60 Data Sheet

Alloys 190 and 290

Materion formulated these mill-hardened copper beryllium strip alloys for automotive and consumer electronics applications in harsh operating environments. Alloys 190 and 290 offer the highest strength of any mill-hardened copper alloy, combined with electrical conductivity considerably greater than other high-strength copper alloys.

Alloy 190 is an excellent strip material for making automotive terminals, medical connector components, battery contacts, and contacts for switches and relays. It doesn't require heat treatment and offers tensile strength up to 190 ksi (1310 MPa).

When compared with Alloy 290, Alloy 190 is flatter and better for precision strip applications and operations that are sensitive to shape, such as photochemical machining.

Download Alloy 190 Data Sheet

Alloy 290 offers the strength of Alloy 190 with greater formability, which allows it to be bent and reformed into specially shaped electrical connectors and contact points. It is an ideal material for board-to-board contacts, audio jack contacts and spring contacts for batteries. Alloy 290 is most often used to fabricate high-reliability components that require complicated connections without losing strength. It is a cost-effective alternative to conventional mill-hardened products.

Download Alloy 290 Data Sheet

Alloys 390 and 390E

Materion's copper beryllium alloys 390 and 390E offer the high strength of Alloy 25 combined with the electrical conductivity of Alloy 3 or Alloy 174. This combination enables greater design flexibility for small form factor signal and power interconnects used in the type of harsh environments characteristic of the consumer electronics, telecom and server industries.

Alloy 390 strip provides a unique combination of high strength and high electrical conductivity, coupled with good resistance to stress relaxation. This combination enables highly reliable small form factor contacts. Mill-hardened Alloy 390 is a go-to solution for computer burn-in and test sockets (BiTS), production sockets, power connectors, switches, relays, handheld and portable electronic contact applications, and automotive power applications.

Download Alloy 390 Data Sheet

Alloy 390E strip retains the strength and high conductivity of Alloy 390 while offering superior formability. It is an excellent choice for production sockets, appliance switches, relays, sensors and controls.

Download Alloy 390E Data Sheet