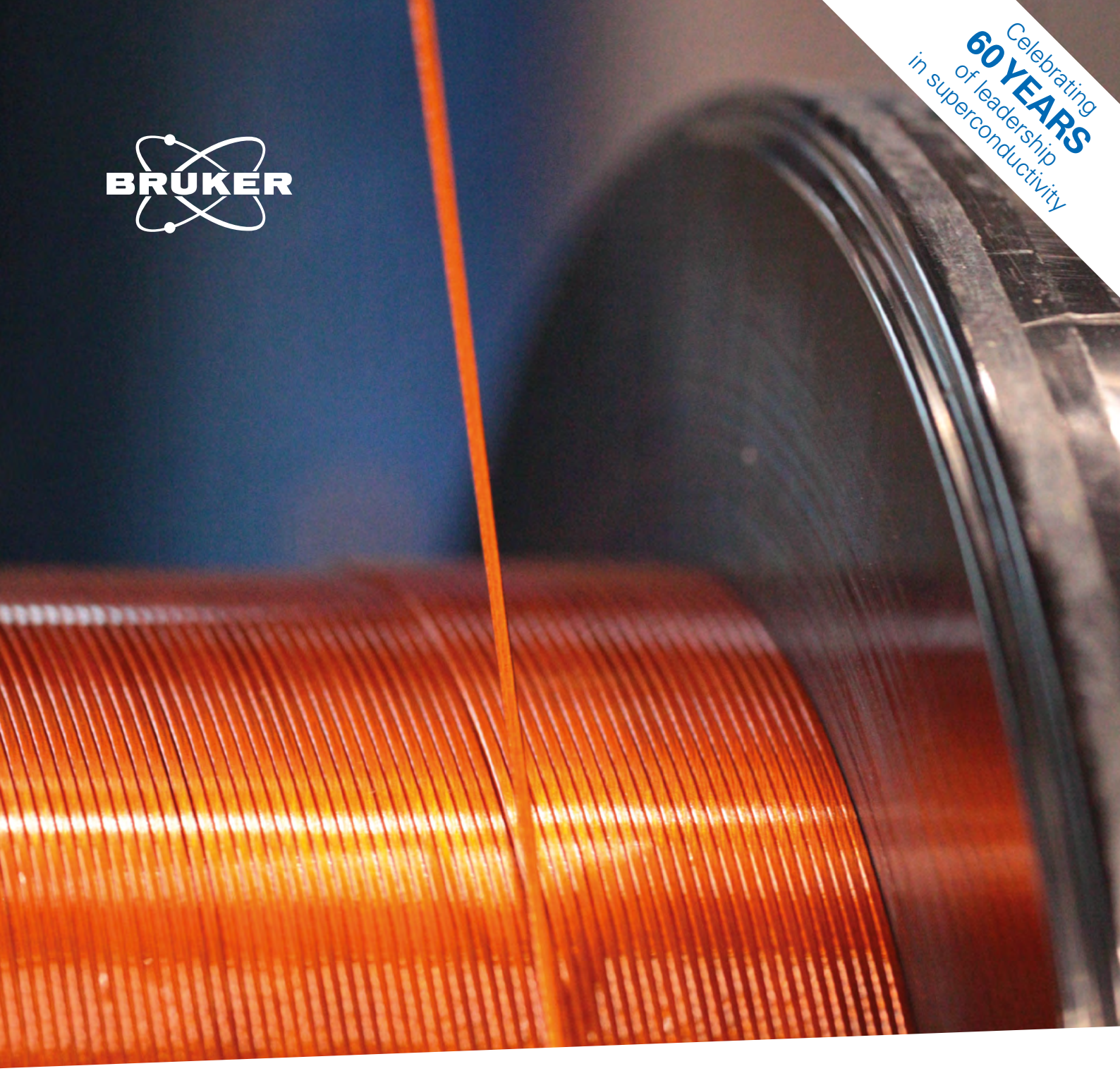


HIGH PERFORMANCE SUPERCONDUCTORS

BRUKER ENERGY AND SUPERCON TECHNOLOGIES

Driving research in clinical, pharmaceutical and advanced materials science

Innovation with Integrity

Bruker EST's state of the art manufacturing plant.

World leading superconductor technology

Bruker Energy and Supercon Technologies (Bruker EST) is the world leader in the production of superconducting wires. The state-of-the-art Bruker EST production sites meet fast growing market demand for high quality, high performance products. Applications include medical, clinical, pharmaceutical, renewable energy and environmental research that demand the technical performance delivered by superconducting wire.

Superconducting wire enables operation of the high strength magnetic fields that are the power behind magnetic resonance imaging (MRI), which has driven countless medical breakthroughs. Pioneering work on sustainable energy production is supporting new ways to combat climate change – and the advanced performance of superconductors is providing the enabling technology behind the research.

A culture of continuous innovation

At Bruker we never stand still. We invest in the best people and world-leading technology to conduct leading edge research into the technological and commercial potential of new superconductors, based on our knowledge and experience in this highly complex field.

Our work drives the advancement of major global initiatives to help conserve the world's energy resources and protect the health of communities.

Global operations

We operate a global presence from our ISO accredited manufacturing sites in Hanau, Germany and Carteret, NJ, USA, as well as our sales office in Shanghai, China, to deliver consistent and reliable service and technical support to our international customer base.

High performance drives high tech applications

Bruker EST's high performance superconducting wires carry up to 100 times the current of conventional copper wires for unrivaled performance. With zero electrical resistance, superconductors are ideal for high stability and low energy consumption applications, such as in the high field magnets that power applications as diverse as magnetic resonance imaging (MRI), nuclear magnetic resonance (NMR) and fusion physics.

Customer led

Our applications specialists work in close collaboration with our customers to support their diverse applications, using our knowledge and expertise in advanced materials to deliver unique solutions to further cutting-edge research that, ultimately, improves the lives of people across the globe.

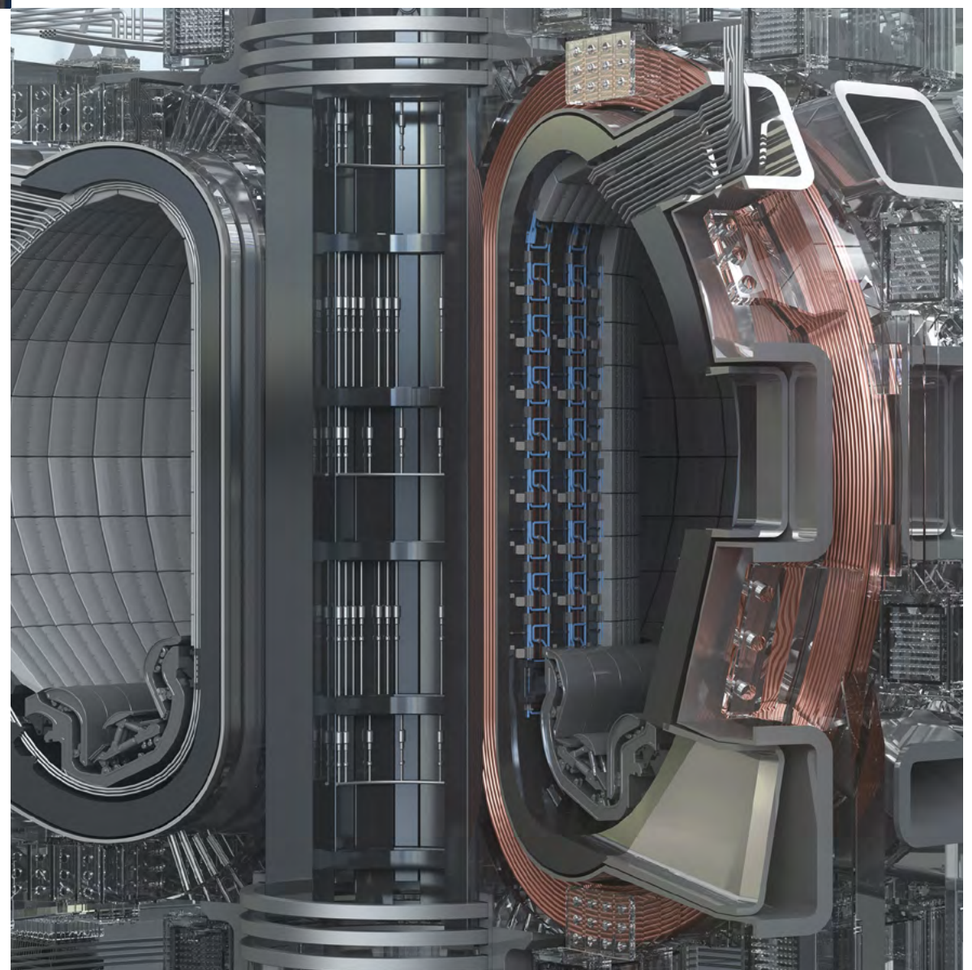
Research and development focus

Our strong focus on research and development, supported by the long Bruker heritage in delivering innovative technologies, has created our world-leading portfolio of high-performance superconductors. We support our customers in pushing the boundaries of technology, paving the way to new possibilities in advanced research.

Advanced technology

MRI is the most versatile diagnostic imaging modality available today and, with over 50,000 MRI systems installed, the largest market for superconductors in the world.

Today, Bruker Nb_3Sn superconductors are used in research magnets as well as NMR systems achieving record persistent field strengths of up to 23.5 Tesla.



Nuclear fusion reactor powered by Bruker EST's superconducting wire.

Celebrating 60 years of superconductor success

With 60 years of leadership in superconductivity, we have grown to be the world's leading supplier of superconductors. Based on our proven values of superior flexibility, reliability and quality standards, we support our customers and partners with best-in-class superconductor solutions.

1962

Research and development begins on the superconducting alloy Nb-Zr (later Nb-Ti) and processing Cu/Nb-Ti composite conductors

1970s

Vacryflux conductor development for NMR spectroscopy applications begins, including thin filaments and Cu-Ni matrix switch wires

The world's first bronze route wires for NMR are introduced

1980s

Optimized Vacryflux wires are first sold into the MRI market

The Euratom coil is built using 20 tons of Nb-Ti wire

Wire coils are supplied to Oak Ridge National Laboratory (TN, USA) to support build of the Tokamak fusion experiment

1984

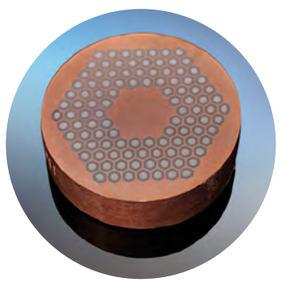
The first wire-in-channel conductor for MRI is produced, today the highest volume conductor used in MRI instruments across the world

1998

High purity aluminum molded flat cable is produced for the ATLAS detector in the Large Hadron Collider (LHC) at CERN

2002

The Rod-Restack Process (RRP®) is launched to support high performance NMR



2005

Bruker acquires European Advanced Superconductors (formerly Vacuumschmelze)

2008

All Bruker superconducting businesses are formally brought under the Bruker Energy & Supercon Technologies brand (Bruker EST), incorporated in Billerica, MA, USA

2009

Bruker supplies 37 tons of chrome plated bronze route Nb_3Sn wire to ITER, the world's most ambitious nuclear fusion project

2012

Bruker relocates all superconductor wire manufacture to its new state-of-the-art plant in Hanau, Germany

2016

Bruker acquires the former Oxford Superconducting Technology wire manufacturing plant in New Jersey, USA

Bruker starts mass production of RRP® conductor for High Luminosity Upgrade of LHC at CERN

2020

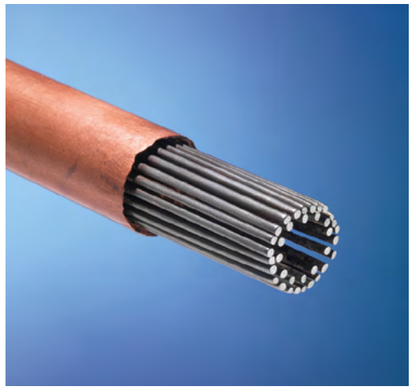
Bruker invests in significant capacity expansion of its wire manufacturing plant in Hanau, Germany

2022

After manufacturing over 4 million kilometers of superconducting wire, Bruker EST celebrates 60 years of leadership and innovation in superconductor technology

Highly specialized products

Superconductors are ideal for high stability and low energy consumption applications because of their zero electrical resistance when cooled below a critical temperature. Bruker's uncompromising product quality delivers best-in-class superconducting technology.



LOW TEMPERATURE SUPERCONDUCTORS (LTS)

Niobium-Titanium (Nb-Ti)

The world's most widely used superconductor, Nb-Ti offers high performance and reliable functionality for a wide range of applications with magnetic fields up to 10 Tesla, roughly 200,000 times the natural magnetic field at the earth's surface.

Its cost-efficiency, superior ductility, and durability in operation under standard conditions at temperatures of 4.2 K enables magnetic fields up to 9.5 T.

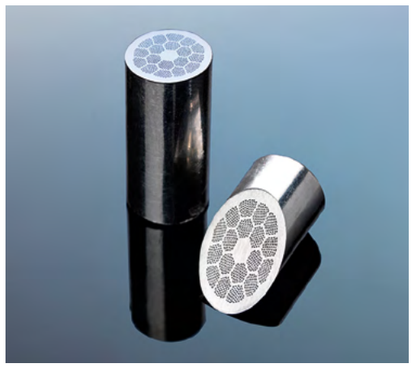
Bruker EST offers a range of multifilament round and rectangular Nb-Ti wires in both monolithic and wire-in-channel formats, as well as customization to precise specifications for individual applications.

Niobium-Tin (Nb_3Sn)

Bruker EST works in close collaboration with customers to develop a range of custom Nb_3Sn conductors tailored to highly specific needs to help push the boundaries of technology.

The high performance of Bruker's Nb_3Sn superconductor wire in magnetic fields of over 20 Tesla set the gold standard in high field magnetic technology.

The unique Bruker Rod-Restack Process (RRP®) conductor portfolio is designed for fusion and high-energy physics applications that demand the highest magnetic fields.

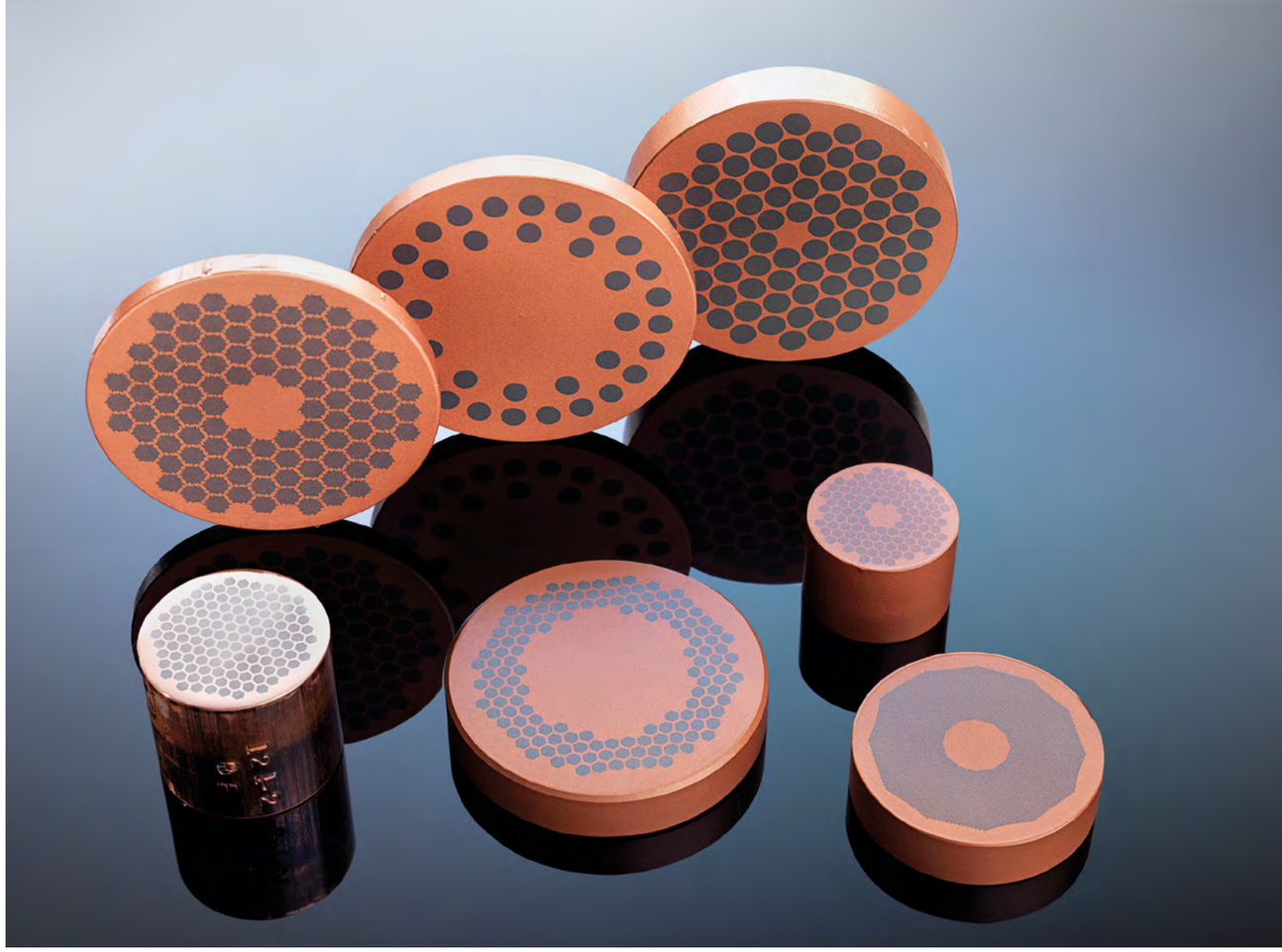


HIGH TEMPERATURE SUPERCONDUCTORS (HTS)

Bruker EST's HTS solutions support high field and ultra-high field applications using round cross-section conductor design and solenoid applications for the electrical and healthcare industries.

Bi-2212

The Bruker Bi-2212 superconductor wire is the only HTS conductor available in a round cross-section and with isotropic performance in all magnetic fields in the temperature range from 4 to 77 K. Manufactured from thousands of filamentary structures, it can be customized for use in fast ramping magnet solutions, offering a twisted multi-filamentary configuration and high performance up to one kilometer.



Hydrostatic extrusions

Cuponal™ is an engineered alternative to copper wire and busbar. Produced by the Bruker EST hydrostatic extrusion process, Cuponal features performance parameters that other methods cannot achieve. Cuponal high conductivity copper-clad aluminum (CCA) retains all the surface properties of copper and provides a cost-effective and weight-saving alternative to solid copper.

Substituting copper with Cuponal can cut purchase and inventory costs by up to 40 percent, and can reduce weight by up to 60 percent, making it more cost-effective to transport, store and handle.

A key application is in aerospace, providing weight savings and improved fuel efficiency for airplanes.

Bruker EST offers a range of multifilament round and rectangular wires in monolithic and wire-in-channel formats as well as customized to precise specifications.

Technology that enables your vision

The most widespread use of Bruker EST's superconductors is in magnetic resonance imaging (MRI), with more than 50,000 installations in clinical, hospital and research applications across the globe. Some of the world's major healthcare breakthroughs, especially in cancer research and drug development, have been enabled by Bruker technology.

Superconductors are also instrumental in the production of clean and renewable energy, and it is here that this technology is starting to make a major difference to the world in helping minimize the impact of climate change.

Our customers rely on our customized superconductor solutions and research to push the boundaries of their vision.

Overview

Nb-Ti superconductor applications Up to 10 Tesla	**Nb_3Sn superconductor applications** Up to 20 Tesla
Clinical magnetic resonance imaging	NMR for research and analysis of molecular structures of proteins and biopolymers
Silicon crystal growth magnets for semiconductor applications	Fusion research for future inexhaustible sustainable energy production
High power generators for wind turbine applications	Scientific research into fundamental properties of matter
Molecular analysis in biotech, chemicals and food	Particle therapy
Industrial processes	Clinical and pharmaceutical research

Supporting the ITER project

The ITER project is one of the most ambitious energy projects in the world that sets out to advance fusion as a large-scale source of energy. Thirty-five nations are collaborating to build a magnetic device to advance fusion science, test the potential of advanced materials, technologies and physics, and pave the way for the energy production of the future. Bruker EST provides the high technology bronze wires needed to drive the project.

Powering particle accelerators

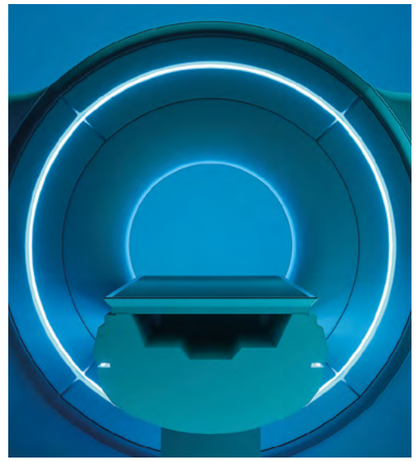
The Large Hadron Collider (LHC), the world's largest and most powerful particle accelerator built by CERN, the European Council for Nuclear Research, is served by a Bruker EST high purity aluminum molded Nb-Ti cable. The LHC's two high energy particle beams travel almost at the speed of light, and are guided by a strong magnetic field. This field is maintained by superconducting electromagnets built using coils of Bruker superconducting wires that conduct electricity without resistance or energy loss.

Driving medical breakthroughs

Clinical magnetic resonance imaging (MRI)
Bruker EST superconductors power the magnets used in MRI instruments in clinical, hospital and research applications. Since its introduction in the 1970s, the radiation-free diagnostic imaging technique of MRI has paved the way to life-changing medical breakthroughs in disease diagnosis and treatment, enabled by the high performance delivered by superconducting wire.

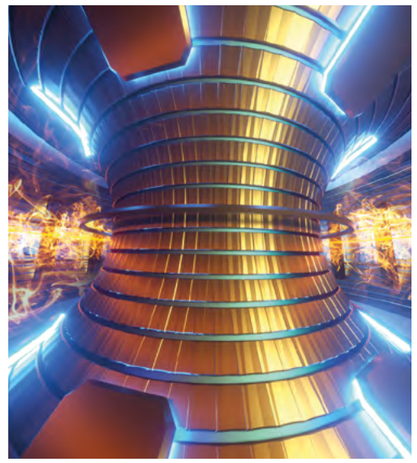
Particle therapy (PT) treatment
Superconductors support PT treatment, a form of radiotherapy, for highly localized cancer therapy.

Nuclear magnetic resonance (NMR) for life science research
Superconductors are used to power the high field magnets that are essential for the operation of technologies used in clinical research, such as NMR, whose performance requires exceptionally high stability and low energy consumption.



Next generation energy

Renewable energy
Large fusion projects rely on Nb_3Sn to power magnets operating above 10 Tesla, supporting research into the next generation of renewable energy.



Supporting industrial applications

Molecular analysis in chemicals and food
Superconducting wire is used in NMR for the analysis of molecular structures of proteins.

Industrial processes
Used in waste separation and crystal growth for the semiconductor and solar industries.

High energy physics applications

Fusion research
Based on the principle of energy generation within the sun, fusion research is exploring sustainable energy production to help combat climate change.

Physics research
Superconducting wire is a key component of particle accelerators to support high energy physics research.

Nb-Ti for MRI applications

Nb-Ti superconductors offer high performance and are the workhorse of the world's superconductor industry. Their major market is clinical MRI, with well over 1,000,000 km of Nb-Ti wire produced to date. Other large markets include NMR spectroscopy and particle accelerators for high energy physics research.

Nb-Ti for NMR and other applications

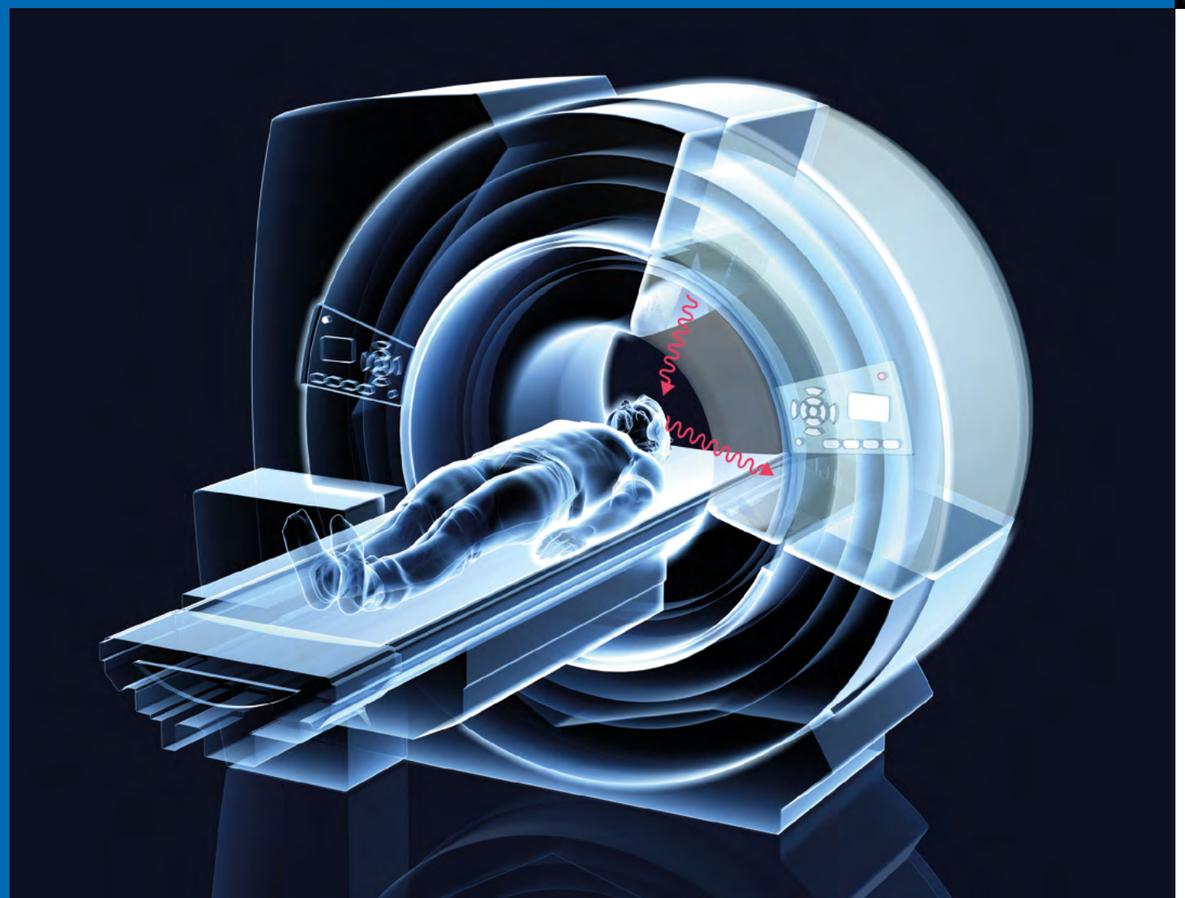
For applications where high engineering current and precise dimensional control are required, we supply wires with Cu:Sc ratios from 1:1 to 7:1, in both round and rectangular cross sections. These are especially applicable in particle accelerators, NMR, and fast ramp magnets.

Nb_3Sn and Nb-Ti for high energy physics applications

Today, Bruker wires are applied at a large scale in high field NMR spectrometry, high energy physics and fusion research. We offer a unique Rod-Restack Process (RRP®) conductor portfolio, which is already being used by leading international fusion and high energy physics projects that require the highest magnetic fields.

Nb_3Sn wires for high magnetic field application

Bruker's higher perfomance Nb_3Sn superconductors offer the gold standard in the world's superconductor industry. With outstanding performance at ultra-high magnetic fields, they are indispensible in the high field magnets used in NMR and mass spectroscopy (FTMS), which routinely exceed 20 Tesla. Large fusion projects also rely on Nb_3Sn for magnets operating above 10 Tesla, paving the way to a future with clean and sustainable energy.



ISO certification and quality control

At Bruker EST our values reflect the high performance, quality, and manufacturing excellence that underpin the entire operation.

A robust policy of continuous improvement ensures the highest quality in production. We operate in full commitment to our vigorous ISO 9001 and ISO 45001 certified quality and safety systems throughout manufacturing.

Environmental responsibility

Bruker takes environmental responsibilities seriously across its global manufacturing base, in compliance with the Environmental Management System ISO 14001 and Energy Management System ISO 50001.

At Bruker EST our innovations contribute to the global energy transition in the drive to minimize the effects of climate change across the world. We are encouraged by renewed attention in the areas of wind and fusion energy, where our superconductors can make a significant contribution to the growth of sustainable energy production.

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About Bruker

Bruker EST is a member of the Bruker group of companies. Headquartered in Billerica, MA, USA, Bruker is a global technology organization that enables the advancement of scientific research. Its world-class analytical instrumentation and diagnostic end-to-end solutions are unlocking breakthrough discoveries that improve the quality of life.

For 60 years, our high performance superconductors have met the needs of healthcare, academic and industrial organizations worldwide, driving new discoveries in the clinical and pharmaceutical sectors, including the breakthrough technology of magnetic resonance imaging (MRI) scanning, advanced materials science, and sustainable energies. Bruker EST superconducting wires carry up to 100 times the current of conventional copper wires, enabling the advancement of technologies such as nuclear magnetic resonance (NMR) whose performance requires exceptionally high stability and low energy consumption.

Bruker EST, October 2022

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For more information on Bruker Energy & Supercon Technologies, click here.