Range of Products

Materials
- Low Temperature Superconductors
- High Temperature Superconductors
- Cuponal™
- Metal Composites
- Customized Wire Products

Devices
- Superconducting Magnets & Devices
- Normal and Superconducting Accelerator Cavities
- Linear Accelerators and Particle Sources
- Circular Accelerators and Beamlines
- Synchrotron Instrumentation & X-ray Optics

Since 1962
- 50 years of Superconductor Wire Manufacturing at Bruker EST
Introduction

Bruker Corporation, a world-leading scientific instruments company founded more than 50 years ago, has always focused on the development of innovative solutions for tomorrow’s analytical and research requirements. This passion drove Bruker in the late 1960s to the development and introduction of superconducting magnets for Nuclear Magnetic Resonance (NMR) systems. Since then, new superconductors have been the basis for many amazing improvements in NMR instrument performance, resulting in the 2009 introduction of the world’s first 1,000 MHz NMR spectrometer, utilizing a 23.5 Tesla magnet built with superconductor wire from Bruker Energy & Supercon Technologies (BEST), Inc.

Fifty years ago, in 1962, the superconductor wire manufacturing facility in Hanau, Germany, then owned by Vacuumshmelze, began operations. From the start, magnetic resonance, high energy physics, and later fusion science were major drivers for the development of metallic superconductor wires, helping to push the technical performance to higher levels. Since the 1980s, clinical Magnetic Resonance Imaging (MRI) has driven superconductor wires to a robust commercial product of high reliability for high volume production.

Over the years, Bruker and Vacuumshmelze have been close collaborators in the optimization, production and application of high performance superconductors for many Bruker NMR, preclinical MRI, EPR and FTMS products incorporating high-field superconducting magnets. In 2003, this close collaboration resulted in Bruker’s acquisition of the superconductor business of Vacuumshmelze. Subsequently, in 2008, BEST was established as a separate division of Bruker Corporation.

A vertically integrated company, BEST also has the broadest superconductor wire portfolio in the world. BEST today covers a broad range of superconductivity products, from advanced metallic superconductors for today’s superconductor applications, via high temperature ceramic superconductors with potential to open up new frontiers for future applications, all the way to superconductivity-enabled tools and devices for research, medical, power and smart grid applications. With its broad superconductivity IP and technology base, and its diversified materials and devices product portfolio, BEST provides one of the key foundations for Bruker’s success today and in the future.

Bruker Corporation congratulates BEST on its 50th anniversary of superconductor wire manufacturing in Hanau!

Frank H. Laukien, Ph.D.
President and CEO
Bruker Corporation (Nasdaq: BRKR

As of 1962

1962 As part of VAC (Vacuumschmelze), we begin with R&D on superconducting alloy NbZr, later NbTi and the processing of Cu/NbTi composite conductors.

1965 Development of superconducting tapes and wires made of V3Ga, later NbSn with the diffusion process and internal tin.

1967 Preparation of first samples of high-field superconductors VACRYFLUX made of Cu/NbTi composite. Two years later, VAC receives a first large order for 56 tons of NbTi superconductor wire for the project BEBC (Big European Bubble Chamber), a high-field magnet for particle detection at CERN.

As of 1970 VACRYFLUX conductor development for NMR applications, e.g.: thin filaments, twisting, CuNi matrix switch wires. Later on, introduction of the first bronze route wires for NMR applications: VACRYFLUX NS (NbSn) and VACRYFLUX HNST ((Nb, Ta)Sn).

As of 1980 Optimized VACRYFLUX-wire types like F24 or F36 are sold in increasing quantities for the prosperous MRI system market.
1980 VAC manufactures 20 tons of Cu/NbTi type F800-4.7 wire, which was ROEBEL cabled in the consortium KFK Karlsruhe / Krupp/Siemens/VAC to build the “Euratom coil”. One of 6 D-shaped coils used at Oak Ridge National Laboratory (TN, USA) to build the Tokamak fusion experiment LCT (Large Coil Task).

1982 For the French Atomic Energy Center (CEA, Saclay) over 20 t of a Cu/CuNi/NbTi mixed matrix conductor of type F9.438 were manufactured for the construction of the tokamak fusion experiment TORE SUPRA in Cadarache.

1985 Construction work on the new VAC plant site III begins. 7600 sqm of floor space for the amorphous metals, mineral-insulated wires and the superconductor wire manufacturing are built. On September 12th, 1986 the inauguration was celebrated.

1986 VAC manufactures 11 tons of aluminum cladded superconducting flat cable made of wire type FS4-1.35 Cu/NbTi for CEA, which is forseen for the ALEPH detector at the Large Hadron Collider LEP (CERN).

1986 For the “HERA” ring accelerator (Hadron Electron Ring Accelerator) at DESY in Hamburg, 12 tons of a Keystone cable are ordered. VAC supplies a Cu/NbTi wire of type F636.

1987 For KFK and CEA, a mixed matrix wire with 1,600 filaments and 1.25 mm diameter is commissioned at VAC. The eye-catching segmented conductor was installed in a forced-cooled cable under the project name “POLO” and used for fusion experiments in the test facility, “Toska” (Karlsruhe).

1987 After discovery of high temperature superconductivity, the development and manufacturing of high-temperature superconductor wires and tapes based on YBa2Cu3O7-x, Bi2Sr2CaCu2O8+x and Bi2Sr2Ca2Cu3O10+x starts in Hanau.
1990  Start of NbTi Wire In Channel (WIC) conductor manufacturing at VAC.

1995  The European Comission in Brussels issues an order to VAC for 6.6 tons of an externally stabilized NSTT 4,675 conductor for the inner part of a model coil (CS Model Coil) for the international fusion project ITER.

1998  For the “ATLAS” detector at the LHC (CERN), 28 km of high-purity aluminum molded flat cable, consisting of 38 wire strands of a Cu/NbTi F306 type wire with a diameter of 1.30 mm, are commissioned. An Ic of 58 KA at 5.0 T/4.2 K is required.

1999  For the LHC dipole and quadrupole magnets, more than 900 km of F8,670 type wire with a diameter of 1.065 mm (double stack) and F6,360 type wire with a diameter of 0.753 mm are manufactured by 2004.

2000  Max-Planck-Institute Greifswald, awarded a consortium of VAC and Europa Metalli (Italy) a contract for chromium coated F144 wire with a diameter of 0.57 mm for W7-X. 60 km of an age hardening aluminum alloy cladded CICC (Cable In Conduit Conductor) are manufactured, consisting of 263 superconducting strands. Ic = 35 KA at 6.0 T/4.2 K. It is used to build a stellarator coil for fusion experiments in Greifswald (Germany).

2003  The English special-materials producer Morgan Crucible plc. - owner of Vacuum-schmelze since 1999 - sells the superconductor wire business to Bruker BioSpin, formerly a major customer of VAC in the segment of NMR and MRI wires. The new company was named European Advanced Superconductors (EAS).

2004  17 km of BSCCO 2223 silver-gold matrix tape for the LHC current leads are ordered by CERN at EAS.

2004  EAS receives an order for insulated BSCCO 2223 wire for a 4MW HTS generator from Siemens.

2004  Bruker acquires the YBCO activities of the “Zentrum für Funktionswerkstoffe” (ZFW) of the University of Göttingen and renames this activity to European High Temperature superconductors (EHTS).

As of 1990

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2005 EHTS manufactures a first 40m long YBCO coated conductor tape with an Ic of 235 A/cm width.

2005/2006 At the end of 2005, all HTS R&D and manufacturing activities are combined under EHTS in Alzenau.

2006 Siemens orders 50 km of insulated silver-magnesium matrix BSCCO 2223 wire for a 4 MW HTS rotating machine for ship propulsion.

2006 After years of close cooperation, EAS acquires the Nb3Sn powder-in-tube technology (PIT, Powder In Tube) of “Shape Metal Innovation” (SMI) in Enschede, NL.

2007 Forschungszentrum Karlsruhe orders a total of 2,850 BSCCO 2223 silver-gold-magnesium matrix HTS stacks from EHTS. The stacks are used to build HTS current leads, feeding the magnet coils of the fusion experiments W7-X (Wendelstein) and JT60-SA.

2008 With the Leibniz Institute for Solid and Materials Research (IFW) Dresden, a contract for joint development of MgB2 conductors is signed. By the end of 2009, a first 1,000 m MgB2 Monel sheath wire is manufactured and tested.

2008 European Advanced Superconductors is renamed as Bruker EAS, EHTS is renamed as Bruker HTS and the Bruker business unit Bruker Energy & Supercon Technologies (BEST), Inc., headquartered in Billerica, USA is established, covering the fields of activity of Bruker EAS, Bruker HTS, Bruker ASC, RI Research Instruments and Bruker Hydrostatic Extrusions.
As of 2009

2009  “Fusion for Energy” (F4E) - the European domestic agency for ITER – awarded Bruker EAS a € 24.5 million wire contract. Within 3 years, 37 tons of chrome plated Nb3Sn NSTT8,305 type wire are manufactured. 900 of these 0.82 mm diameter wire strands will be implemented with 522 copper strands in a forced flow cable.

2009  Bruker BioSpin installs the world’s first commercial 1 GHz NMR system, “AVANCE 1000™” at the CRNM (Lyon, F). Bruker EAS was significantly involved in the wire development for the 23.5 T magnet.

2009  In the project “Super Coated Conductor Cable” (SUPER3C), a 30 m long YBCO cable is built and tested in collaboration with the cable manufacturer Nexans.

2010  For the project “Inductive Superconducting Fault Current Limiter” (iSFCL), funded by the German government BMWi, a consortium of Stadtwerke Augsburg, Schneider Elektik, Bruker ASC and Bruker HTS develops a YBCO HTS iSFCL, which will be installed and tested in a demonstration unit at Stadtwerke Augsburg.

2011  Bruker HTS decides to focus on YBCO coated conductors. Heavy investments for building up a production line for YBCO wire unit length > 1000 m. Close down of the BSCCO activities.

2011  Bruker EAS signs long term contracts with its major MRI customers exceeding USD 70 million.

2012  Bruker HTS signs a large-scale technology transfer contract to license and transfer know-how for second generation (YBCO) ceramic type HTS conductors to a subsidiary of the Russian state atomic energy corporation, Rosatom. The contract value exceeds USD 25 million.

2012  Bruker EAS relocates in its 50th year of superconductor wire manufacturing to its new manufacturing facility in Hanau.