REBCO Coated Conductors for Ultra-High-Field NMR Magnets

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***Abstract*—The availability of ReBCO coated conductors of sufficient length and quality during the last decade was the precondition to push magnet technologies for Ultra-High-Field (UHF) NMR spectrometers beyond the limit of LTS conductors at about 1.0 GHz (23.5 T). After an intensive R&D period, Bruker produced and delivered the first 1.1 GHz (25.8 T) UHF NMR spectrometer, based on a hybrid LTS-HTS technology, in 2019, followed by the first 1.2 GHz (28.2 T) UHF NMR spectrometer a year later. In the meantime, seven UHF NMR spectrometers above 1.0 GHz have been delivered to customers.**

In addition to enabling these record fields, the very high current density of ReBCO coated conductors permits the development of compact magnets, like the single-story 1.0 GHz 4K NMR magnet, which reached field in Bruker's factory earlier in 2022. Major advantages of this *Ascend Evo 1.0 GHz* system, compared to 2K LTS 1.0 GHz systems, are significantly reduced weight, liquid helium consumption and space requirements (lab area and ceiling height).

In this presentation we will shortly summarize the challenging requirements of UHF NMR magnets (i.e., homogeneity, drift, force management, etc.), present Bruker's UHF NMR magnet program and discuss its main requirements on ReBCO coated conductors. Especially important for NMR magnets are i) uniform properties along entire piece lengths, ii) long piece lengths without Ic dropouts, and iii) high Ic values at high magnetic fields and low temperatures. Only thorough quality assurance and quality control processes, from conductor procurement and throughout the entire magnet production process, ensure compliance to these stringent requirements on the ReBCO coated conductors.

***Keywords (Index Terms)*—High-field magnet, NMR magnet, superconducting magnet, coated conductors**

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