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REBCO Coatings for High-Energy Physics Applications Under High Magnetic Fields

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***Abstract*— Emerging high-energy physics (HEP) technologies require excellent RF response under high-magnetic fields, like CERN's FCC-hh high-energy accelerator, or Dark Matter Axion haloscopes. At the operating conditions of these technologies, penetration of magnetic field lines into the superconductor is unavoidable, thus, its RF response is governed by vortex pinning. Consequently, the HEP community abandoned Nb-based superconductors and turned its attention to Cu. However, we demonstrated that under the very-high magnetic fields required for such applications, REBCO offers outstanding, better-than-Cu RF response [1,2,3]. Unfortunately, its usage in RF applications is impeded by complicated material growth that requires meticulous stoichiometry control and biaxially textured templates, making it virtually impossible to grow REBCO directly on the geometrically complex surfaces required for HEP applications.**

In this talk, we present our research achievements over these years [1]. We have worked towards understanding the high-field microwave response of REBCO coated conductors (CCs) and demonstrated its better-than-Cu RF surface resistance up to fields of 16T. Beyond the vortex physics measurements and performance understanding at RF fields, high-magnetic fields and low temperatures, we will also present our developments on a coating technique using CCs to cover flat and curved surfaces; and our developed hybrid CC /Cu. Our findings have placed CC's technology as a solid candidate to replace Cu as the low surface-impedance coating in HEP applications.

[1] T. Puig et al, Supercond. Sci. Technol. 32 (2019)
[2] A. Romanov et al. Scientific reports 10 (2020)
[3] J. Golm et al. IEEE Trans. App. Supercon. 32 (2022)

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