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Feasibility Study on CCT Magnet Design based on Narrow-Stacked HTS wire

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Canted-Cosine-theta (CCT) magnet is an excellent dipole magnet structure design for developing high-field accelerator magnets, because of its modular construction and the prevention of the Lorentz-force-induced conductor stress accumulations. Although REBCO tapes can maintain a relatively higher engineering current density than other superconducting conductors in the high field environment, it is not easy to apply REBCO tapes in CCT magnets directly. The stress challenge and the large tilt angle of the flat REBCO tapes demand to optimize the conductor structure for the practical application. In the previous work, Narrow-Stacked (NS) wire has been confirmed as a novel REBCO conductor structure with many advantages, such as low AC loss, small screening current induced field (SCIF) and available no-insulation technique. Owing to the 1-mm width of NS wire, the minimum tilt angle can be reduced effectively to avoid the superconducting characteristic being degraded during slantwise winding. NS wire has a smaller limit than original REBCO tape in HTS magnet applications. Therefore, NS wire is a suitable method to use the REBCO tape in CCT magnet. In this paper, a small CCT prototype based on NS wire was designed and fabricated, then it was also tested at 77K to verify the feasibility of the CCT magnet based on NS wire. This paper result will provide a new way to apply REBCO tapes in CCT magnet.

Primary author: WANG, Mingyang (Shanghai Jiao Tong University)

Presenter: WANG, Mingyang (Shanghai Jiao Tong University)

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