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## Development of superconductors for future large scale applications

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Particle accelerators have been an important driver of superconductor development, and Nb-Ti technology has enabled, in the last thirty years, fundamental discoveries in high energy physics. While the Large Hadron Collider continues delivering data and investigating the experimentally achievable domain, the quest for new sub-nuclear phenomena, beyond the Standard Model, has generated studies on future 100 TeV-scale synchrotron machines based magnets capable of delivering fields of 16 to 20 T. Nb<sub>3</sub>Sn is to date the baseline superconducting technology of the Future Circular Collider (FCC). A key technological challenge of the FCC study is the R&D aimed at exceeding present state-of-the-art performance in a cost effective Nb<sub>3</sub>Sn superconductor, and a world-wide effort on conductor development has recently been launched by CERN. In the last decade, the landscape of superconducting materials showing potential for accelerator technology has significantly enlarged. Nb<sub>3</sub>Sn will be used in the High Luminosity LHC (HL-LHC) upgrade; REBCO conductors, with superior performance, have become commercially available from several companies; BSCCO 2212 has demonstrated in-field capability; on a longer term perspective, encouraging fundamental properties of MgB<sub>2</sub> and iron-based materials motivate studies for understanding and improving their in-field characteristics. For electrical transmission, LHC and HL-LHC rely respectively on BSCCO 2223 and MgB<sub>2</sub>. The challenges and potential of both low-temperature (LTS) and high-temperature superconductors (HTS) are presented, with close attention being paid to the requirements driven by future high energy accelerators. Considerations on targets of performance and cost of Nb<sub>3</sub>Sn and HTS superconductors, which could enable their adoption in large scale applications, are discussed.

### Submitters Country

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