Abstract

Classical and High Temperature Superconductors: Practical Applications and Perspectives at CERN

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High-energy physics has been a major driving force in the development of applied superconductivity, the two fields becoming an example of unique merging between fundamental physics research and technological development. The continuous quest for higher fields required by high performance magnets for particle accelerators stimulated the development of state-of-the-art conductors suitable for large-scale applications. It is thus that Nb-Ti alloy went through a significant performance improvement and has become a mature industrial conductor, today pushed to its practical limits. The A15 compounds, of which Nb3Sn is the principal example, are presently the conductors of choice for very high field magnets. Due largely to more challenging mechanical characteristics their use to date has been mainly confined to niche applications such as laboratory magnets, but development of conductor suitable for the next generation of accelerator magnets is bearing fruit and the requirements of fusion science is giving impetus to their development on an industrial scale. High-temperature superconductors are more recent innovations for research laboratories. Their unique characteristics have already led to important applications for some auxiliary systems, and thanks to steady progress in performance they may become an attractive alternative to conventional low temperature superconductors for specific types of magnets. An overview of the application of both low temperature and high temperature superconductors to the CERN Large Hadron Collider is presented, together with perspectives on the future needs of the accelerator.