TUTORIAL

Material Science in Superconductor and Its Applications

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Since the discovery of the high-temperature (T_c) oxide superconductor in 1986, many superconducting materials have been discovered and studied to understand the superconductivity mechanism and applications. Researchers find out that the high-T_c superconductors have several weak points which make it difficult to realize the practical applications. They are a weakly coupled grain boundary, short coherency length, anisotropy in current flow due to the layered crystal structure and brittleness. To solve these problems, special techniques such as coated conductor architecture which controlled grain alignment and powder-in-tube method which offers a way of long length wire fabrication have been developed. Compared with the oxide superconductors, recently discovered MgB_2 superconductor has no such kinds of problems. Although the superconducting transition temperature (40K) is lower than that of the high-T_c superconductors (90K-120K), the wire fabrication and raw material costs are cheaper, the grain boundaries are more strongly coupled, the anisotropy in current flow is smaller. Theses are attributed to the longer coherency length of MgB_2 superconductor. In this tutorial talk, the properties related to the practical applications of superconducting materials and the way of solving problems will be discussed.

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