Development of Doped M_gB_2 Wires and Tapes for Practical Applications

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Abstract - A review of current developments in the study of chemical doping effect on the superconducting properties of M_gB_2 wires and tapes is presented, based on the known literature data and our own results. The critical current density of M_gB_2 can be improved through various kinds of dopants. Among these dopants, doping with carbon-containing materials seems to be the most effective way to improve the J_c performance. The doping effect of carbon in different forms and carbon-based compounds such as SiC, nano-C, metal carbides, as well as aromatic hydrocarbon and carbohydrate on the J_c-B characteristics of M_gB_2 was discussed in detail. The C can be incorporated into the M_gB_2 crystal lattice by replacing boron, and thus B_{c2} is significantly enhanced due to selective tuning of impurity scattering of the π and σ bands in the two-band M_gB_2. Besides the efforts of increasing B_{c2} by carbon doping, the fine grain size and nano-size inclusions caused by doping would create many flux pinning centres improving the J_c-B property of M_gB_2. Based on these considerations, we suggested some principles for the selection of dopants.

Index Terms—M_gB_2, critical current, doping, Carbon, tapes and wires.

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