

Magnetic Properties of rare-earth-free permanent magnets : MnBi

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The low-temperature-phase(LTP) of MnBi is one of the promising candidates for a potential rare-earth-free permanent magnetic material. It has large magneto-crystalline anisotropy at room temperature, $K \approx 10^7$ ergs/cc and unusual increase of coercivity with increasing temperature. However Mn and Bi are difficult to alloy because of the large difference in their melting points. Moreover it is generally recognized that it is too difficult to obtain a single-phase of LTP-MnBi because there are peritectic reactions over wide temperature and Mn reacts readily with oxygen. In this study, high purity LTP-MnBi of 95.1% was obtained by arc-melting, melt-spinning, annealing and magnetic separating. The starting alloy contained 5% excess of Mn compared with the normal composition of Mn₅₀Bi₅₀ to compensate for losses of Mn due to soots during arc-melting and melt-spinning. Different compositions, heat treatment, ball milling time and bulk magnet fabrication processes were found to have large effects on the large product of the bulk magnet.