Rare-Earth-Free Permanent Magnets as a Next-Generation Magnet: MnBi-Based Alloys

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For the last three decades, rare-earth (RE)-based magnets have dominated permanent magnetic applications. Although numerous studies have been done to find a new candidate as a next-generation magnet owing to the rare-earthmetal crisis, the solution still remains elusive. Also, there are two important obstacles in the RE-based magnets to be used in high efficiency sustainable energy applications, *i.e.,*operating temperature and unstable price of the RE elements. Very recently, Y.K Hong, *et.al* have been developing new iron- and manganese-based composite materials for use in the electric motors of electric vehicles and renewable power generators. Their First-principles calculations for MnBi-Co and MnBi-Co-Fe have demonstrated magnetic properties superior to today's best rare-earth-based magnets. MnBi in it slow-temperature phase (LTP) shows attractive hard magnetic properties; high uniaxial magnetocrystalline anisotropy and an unusual positive temperature coefficient of coercivity. In fact, it is difficult by conventional synthesis techniques such as arc-melting, rapid solidification and sintering to make single phase MnBi. This is because it forms through peritectic reaction ata relatively low temperature. A comprehensive review on the MnBi-based alloys is introduced at the viewpoints of theory and experiment.

[1] Y.K Hong, *et.al*, AIP ADVANCES 3, 052137 (2013)