Evolution and Degradation of Magnetic MnBi Phase

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Abstract: Permanent magnets used in most electronic devices still rely on a certain content of rare-earth elements while the newest trend is a total reduction or substitution of those. A comfortable and simple solution is conveniently offered by magnetic Mn compounds. Magnetic properties of $Mn_{55}Bi_{45}$ alloy are determined by the presence of ferromagnetic MnBi phase. This metastable low temperature phase prepared by planar flow casting and followed by specific annealing process, has been studied by several techniques. The controlled heat treatment helps to scale up the magnetic properties resulting from the structural transformation. We have investigated the dependence of magnetic phase content with respect to primary chemical composition in master alloy, the structure evolution from as cast state to the required one after processing and the gradual decay of magnetic phase in time and temperature. The formation and evolution of magnetic crystalline phases were monitored by the structure analysis using X-ray diffraction. Phase transformations and their degradation in temperature and time were directly characterized by thermal analysis techniques (differential scanning calorimetry and thermogravimetry). Crystal structure of ribbons in as-quenched state was investigated by X-ray diffraction. Long-term time evolution of stability of structure and properties was studied at different lower temperatures on samples after the original aging process.