Probing the Structural and Critical Temperature of Weak- and Strongly-Coupled Bimetallic Superconducting Alloys

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Abstract

We have studied the dependency of superconducting transition temperature T_C of weak- and strong-coupled bimetallic alloys with respect to initial composition and discuss its behavior intern of the category of alloy [1-4]. Two sets of bimetallic alloys were fabricated over huge initial -composition using the simple physical method in Ar-gas atmosphere. In the first set, we fabricated Bi_xIn_{1-x}, $Bi_xSn_{1-x,}$ and Bi_xPb_{1-x} ($0.01 \leq x \leq 0.99$) alloys by doping Bi into weakly-coupled In, Sn and strongly-coupled Pb. In the second set, we fabricated In_xSn_{1-x}, $Sn_xPb_{1-x,}$ and In_xPb_{1-x} ($0.01 \leq x \leq 0.99$) alloys by doping a weak-coupled superconductor (In and Sn) into both weak- (Sn) and strong- (Pb) coupled superconductors. The structural investigation of the alloys was carried out by refining synchrotron radiation X-ray diffraction pattern revealing the formation of crystalline phases. Enhanced superconducting transitions were obtained from the magnetization for both weak- and strong-coupled superconducting alloys, revealing a main diamagnetic Meissner state below T_C. A crystalline phase diagram, along with corresponding T_C for each alloy with respect to initial composition, has been investigated. The observed enhanced T_C has discussed interns of a combined effect of coupling strength (weak- to strong-coupling) and the phonon energy (hard to soft phonon).

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