Abstract of Presentation

Synthesis of New Layered Oxide Pnictides with Thick Blocking Layers and Their Superconducting Properties

Abstract :

Since the discovery of high-T_c superconductivity in a layered iron pnictide system, REFeAsO, a large number of new compounds, such as $AEFe_2As_2$, LiFeAs and FeSe, have been successively found. However, T_c of these compounds decreased with an decrease in the interlayer distance between iron planes, while the electromagnetic anisotropy is quite small in those compounds. On the other hand, several layered oxide sulfide systems having alternate stacking of anti-fluorite-type sulfide layer and perovskite-type oxides have been discovered in these 15 years. These oxide sulfide systems suggested that perovskite-type oxide layers can be introduced between the anti-fluorite-type 3d pnictides layers. Through many attempts to develop new layered 3d pnictide oxides with perovskite-type local structure, we have discovered more than twenty new compounds and more than five new crystal structures. The chemical formula of these new compounds can be expressed as $(M_2Pn_2)(AE_{n+2}M'_nO_{3n})$ or $(M_2Pn_2)(AE_{n+1}M'_nO_{3n-1})$, where M = Fe or Ni, Pn=P or As, AE=Ca, Sr, Ba and M'=Sc, V, Cr, (Mg,Ti), etc. and n = 2,3,4,5,⋯. The interlayer distance between the 3d metal layers is quite long in these compounds and, in particular, it is longer than 2 nm in the compounds with $n > 4$. Most of these compounds with M=Fe exhibit superconductivity with T_c's of 35~47 K. It should be noted that T_c does not depend on n, *i.e.*, thickness of the blocking layer. This means that the T_c of these compounds is simply determined by the local structure and electronic state at the iron pnictide layer. Magnetization measurements performed for these compounds revealed that their irreversibility lines located at much lower fields than those of REFeAs(O,F) and $AE(Fe,Co)_2As_2$. In addition, compounds with larger n showed lower irreversibility fields as low as that of Bi-based cuprates when we compare them in normalized temperature by T_c. These indicaed that electromagnetic anisotropy of newly discovered compounds is quite large. In other words, the two dimensional characteristics is more pronounced by an increase in the interlayer distance, which is well known as a general tendency of cuprate superconductors. Critical current properties of these new compounds will be compared with other layered oxide pnictide systems and cuprate superconductors.