RECIPES TO IMPROVE THE PERFORMANCE OF IRON CHALCOGENIDE SUPERCONDUCTORS

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Abstract

High-Tc superconducting materials such Fe-based and cuprates superconductors have a layered structures as shown in fig. 1. In these compounds, superconducting layers and blocking layers are stacked alternately. Many Fe-based superconductors have been found by arranging the blocking layer so far.

11-type iron chalcogenides, such as FeSe, have the simplest crystal structure among the iron-based superconductors as they are composed of only superconducting layers. However, a small amount of excess iron exists between these superconducting layers, which suppress the superconductivity.

Manipulation of excess iron is required to induce bulk superconductivity in 11 types. We have successfully developed several ways to remove the effect of excess iron from 11 type iron-based superconductors using annealing processes. We have found that oxygen annealing suppress the excess Fe effect and can achieve bulk superconductivity in the 11 system. Alcoholic beverage annealing can also remove excess Fe and induce bulk superconductivity. A further consequence is that the critical current density Jc is also dramatically improved by sulfur annealing.

Further to this, we have recently succeeded in the inducement of superconductivity using an electrochemical reaction similar to that of a Li-ion battery. The excess iron is de-intercalated by an applied electronic current. In my presentation, I will talk in detail about crystal architectonics using electrochemical reaction and the mechanism behind the inducement of superconductivity in iron chalcogenides.

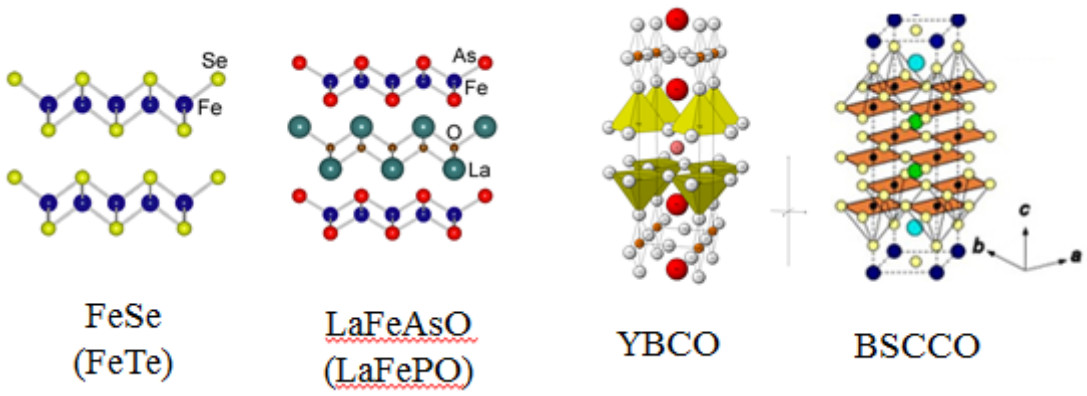

Fig. 1 Schematic of crystal strucure of layered superconductos.

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□Profile□

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Previous Appointments

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Research Fields

Since superconductors can transport energy without loss, it is expected that superconductivity is a key solution technology to energy problems. We are focusing on the physical properties of Fe-based superconductors, diamond superconductors, high-Tc superconductors and carbon nanotubes. We have developed a superconducting wire using newly discovered superconducting materials. Development of novel devices, including optical and field effect devices, using superconductors and nano-technologies are targets.

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