Superconductivity in iron selenide $K_{0.8}Fe_2Se_2$

J. G. Guo[a], S. F. Jin[a], G. Wang[a], S. C. Wang[a], K. X. Zhu[a], T. T. Zhou[a], M. He[b], and **X. L. Chen**[a]

[a]Research & Development Center for Functional Crystals, Beijing National Laboratory for Condensed Matter Physics, Institute of Physics, Chinese Academy of Sciences, Beijing 100190, China
[b]National Center for Nanoscience and Technology, Beijing 100190, China

Since the discovery of superconductivity in doped LaOFeAs, a series of superconducting iron-based compounds were found. Among them, FeSe has a substantially simplified structures stacked only by FeSe layers and no interacting cations. We reported a new iron-based superconductor $K_{0.8}Fe_{1.7}Se_2$ with transition temperature at about 30 K, which was synthesized by intercalating alkali-metal K in between FeSe layers. This new superconductor adopts a similar structure to $BaFe_2As_2$ while with a considerable amount of Fe vacancies in the FeSe layers. Phase transitions due to the Fe vacancy order occur at different temperatures. Meanwhile, Superconductivity at 43 K was often observed in resistivity and magnetization curves. Altering the synthesizing or annealing conditions result in enhancing or weakening the superconductivity at 43 K, implying the existence of an unknown superconducting phase. Furthermore, the rapid suppression of superconductivity by magnetic Co-doping is also reported. The pairing mechanism of the material has been proven to be different with all other known iron-based superconductors. The results may have important implications for understanding the superconductivity mechanism of iron-based superconductors and may shed a new light on exploring new high-temperature superconductors.

INVITED PAPER