

Abstract for the Eurasia-Pacific Summer School and Conference 2012 (Invited talk)

Scanning Tunneling Microscopy Study of K-doped Iron Selenide Superconductor Film by MBE

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The alkali-doped iron selenide superconductors have generated considerable excitements as well as confusions, regarding the delicate interplay between Fe vacancies, magnetism and superconductivity. We have grown high-quality $K_xFe_{2-y}Se_2$ thin film with (110) surface orientation on graphene and (001) surface orientation on $SrTiO_3$ (STO) substrate by molecular beam epitaxy (MBE). The scanning tunneling microscopy measurement confirms the phase-separation scenario and demonstrates that the $K_2Fe_4Se_5$ phase with $\sqrt{5}\times\sqrt{5}$ Fe vacancy order is an insulator. We find two superconducting phases: striped KFe_2Se_2 in adjacent to $K_2Fe_4Se_5$ and KFe_2Se_{2-z} with Se vacancies. Both phases have a superconducting gap of 9 meV. These findings elucidate the existing controversies on the role of $\sqrt{5}\times\sqrt{5}$ Fe vacancy order in superconducting $K_xFe_{2-y}Se_2$.