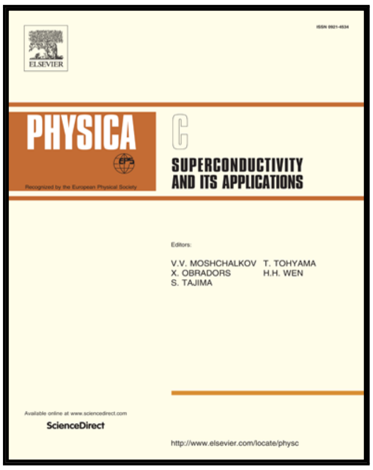

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Fermi Surface and Band Structure of BiPd from ARPES Studies

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Abstract

We present a detailed electronic structure study of the non-centrosymmetric superconductor BiPd based on our angle resolved photoemission spectroscopy (ARPES) measurements and Density Functional Theory (DFT) based calculations. We observe a high intensity distribution on the Fermi surface (FS) of this compound resulting from various electron and hole like bands which are present in the vicinity of the Fermi energy (E_f). The near E_f states are primarily composed of Bi-6p with a little admixture of Pd-4$d_{x^2-y^2/zy}$ orbitals. There are various spin-orbit split bands involved in the crossing of E_f making a complex FS. The FS mainly consists of multi sheets of three dimensions which disfavor the nesting between different sheets of the FS. Our comprehensive study elucidates that BiPd could be a s-wave multiband superconductor.

Keywords: , Angle resolved photoelectron spectroscopy, Electronic structure calculation, Superconductor
PACS: 74.25.Jb, 74.70.Dd, 71.20.Be

1. Introduction

An upsurge has been witnessed recently in the search for novel materials after realizing the significant role of spin-orbit coupling (SOC) effects in the modification of near Fermi level (E_f) electronic structure of materials and thereby their physical properties. For example, presence of a strong SOC produces conducting edge states in topological insulators (TIs)[1, 2]. Similarly, intertwining of the spin-orbit interaction with non-centrosymmetric (NCS) structures gives rise to some exotic phenomena of mixing up of spin-singlet and triplet Cooper pairing channels[3, 4] in superconductors (SCs). The anomalous value of upper critical field (H_{c2})[5, 6], presence of Majorana surface states at the junction of superconducting transition temperature (T_c)[7, 8] and existence of Weyl fermion surface states in Weyl semimetals[9] are a few more interesting properties related to the NCS structures behaving under SOC effects. These new class of materials not only present intriguing physics but also have tremendous scope in various applications.

One of the interesting aspects of the NCS crystals is a broken inversion symmetry that gives rise to antisymmetric spin-orbit interaction (ASOC) which has been theoretically predicted to form an unconventional pairing in the NCS SCs. However, most of the NCS SCs, like $Mg_{10}Ir_{19}B_{16}$[10], Mo_3Al_2C[11], $Re_{24}Nb_5$[12], Re_3W[13] show conventional s-type superconducting behavior which is attributed to the weak SOC in these compounds. The pairing mechanism becomes quite complex due to strong electron correlation effects in some other SCs of the NCS family,

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