Character of charge carriers in a low-carrier superconductor \( \text{Ag}_5\text{Pb}_2\text{O}_6 \) revealed by core-level photoemission

SOOBIN SINN, IBS-CCES, Seoul National University, KYUNG DONG LEE, CHOONG JAE WON, Inha University, TAMIO OGUCHI, Osaka University, JI SEOP OH, HYANG KEUN YOO, CHENG-TAI KUO, IBS-CCES, Seoul National University, MOONSUP HAN, YOUNG JUN CHANG, University of Seoul, NAMJUNG HUR, Inha University, BYEONG-GYU PARK, Pohang Accelerator Laboratory, CHANGYOUNG KIM, HYEONG-DO KIM, TAE WON NOH, IBS-CCES, Seoul National University —

Identifying an element-specific orbital character of electrons near the Fermi level is important to understand electronic properties of a metallic solid, as manifested in high-\( T_c \) superconducting cuprates in which doped-hole and –electron characters are different from each other. Photoemission spectroscopy (PES) may serve as an ideal tool for that purpose by varying photon energies. However, in the case of a low-carrier superconductor \( \text{Ag}_5\text{Pb}_2\text{O}_6 \), distinguishing between \( \text{Ag} 5s \) and \( \text{Pb} 6s \) conduction bands is difficult by the technique. Here, we present another method utilizing core-level PES. The \( \text{Pb} 4f \) spectrum exhibits a quite asymmetric line shape unlike the \( \text{Ag} 3d \) spectrum. The asymmetry can be attributed to electron-hole pair excitations across the Fermi level in the \( \text{Pb} 6s \) band affected by strong local attractive Coulomb potential due to the \( \text{Pb} 4f \) hole. However, the \( \text{Pb} 4f \) spectrum is not explained by the well-known Doniach-Šunjić line shape for a simple metal. By employing \( \text{Pb} 6s \) PDOS from first-principle calculations, the line shape is successfully generated, thus confirming that the main charge-carrier character in \( \text{Ag}_5\text{Pb}_2\text{O}_6 \) is \( \text{Pb} 6s \) electrons.

Soobin Sinn
IBS-CCES, Seoul National University

Date submitted: 11 Nov 2016

Electronic form version 1.4