Angular dependence of x-ray absorption spectrum for field-aligned Fe-based superconductors

Y.B. YOU, B.C. CHANG, M.F. TAI, H.C. KU, National Tsing Hua University, Hsinchu, Taiwan, Y.Y. HSU, National Taiwan Normal University, Taipei, Taiwan, L.Y. JANG, J.F. LEE, National Synchrotron Radiation Research Center, Hsinchu, Taiwan — Anisotropic Fe K-edge and As K-edge x-ray absorption near-edge spectrum measurements on superconducting ($T_c=52$ K) ($\text{Sm}_{0.95}\text{La}_{0.05})\text{FeAs(O}_{0.85}\text{F}_{0.15}$ field-aligned microcrystalline powder are presented. The angular dependence of Fe pre-edge peak (dipole transition of Fe 1$s$ electrons to Fe 3$d$/As 4$p$ hybrid bands) relative to the tetragonal $ab$ plane of aligned powder indicates larger density of state along the $c$ axis and is consistent with the local-density approximation band-structure calculation. The anisotropic Fe K-edge spectra exhibit a chemical shift to lower energy compared to FeO which are closely related to the itinerant character of Fe$^{2+}$ 3$d^6$ orbitals. The anisotropic As K-edge spectra are more or less the mirror images of Fe K-edge due to the symmetrical Fe-As hybridization in the FeAs layer. Angular dependence of As main peak (dipole transition of As 1$s$ electrons to higher-energy hybrid bands) was observed suggesting character of As 4$d$ $e_g$ orbitals.