Angle-resolved photoemission study on (Sr,La)$_2$IrO$_4$

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1 Introduction

5$d$ electron system is acquiring attention of the condensed matter field as a system where the energy scale of spin-orbit coupling is as large as those of Coulomb interaction and transfer integral, to produce possible novel phenomena. Among them, Sr$_2$IrO$_4$ has been regarded as a promising candidate for superconductor since it has been proposed that the insulating behavior of the sample is originating from the splitting of $J_{\text{eff}}=1/2$ band due to strong correlation [1]. The sample is isostuctural to one of cuprates La$_2$CuO$_4$ and shows an antiferromagnetic order below $T_N=240$ K. The emergence of superconductivity in doped system has been predicted by theoretical studies [2] although there has been no corresponding experimental report so far. Nevertheless, it has been reported that K-doped sample surface shows peculiar electronic structure with anisotropic excitation gap [3] reminiscent of pseudogap in cuprates. The existence of similar electronic state has been also reported recently in the cleaved sample surface of Sr$_2-x$La$_x$IrO$_4$[4]. Further detailed investigation of this pseudogap-like state in electron-doped iridates has been highly anticipated.

In this work, we have performed angle-resolved photoelectron spectroscopy on Sr$_2$La$_0.08$IrO$_4$ (x = 0, 0.08). We have measured electronic structure at temperatures both below and above $T_N$ of crystals, in order to find out how the pseudogap reacts by raising temperature.

2 Experiment

Single crystals of Sr$_2$IrO$_4$ and Sr$_{1.02}$La$_{0.08}$IrO$_4$ were synthesized by flux method.

ARPES measurements were performed at BL-28A, Photon Factory. The energy resolution was set at 30 meV. We used circularly polarized light of $h\nu=100$ eV to excite photoelectrons. The Fermi energy of the sample was referenced to that of gold which had electronic contact with samples.

3 Results and Discussion

We show in Fig. 1(a) ARPES intensity plot of Sr$_{1.10}$La$_{0.08}$IrO$_4$ as a function of two dimensional wave vector at binding energy of 50 meV, taken at $T=100$ K. (b) ARPES intensity plot along $\Gamma X$ direction at $T=100$ K. (c) same as (b) at $T=260$ K. (d) and (e) second derivative of (b) and (c). (f) EDCs taken at $k$-point indicated by an arrow in (b).

References


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