ESSC 발표 1

Novel ground state properties in 4*d* and 5*d* transition metal oxides: a high resolution photoemission study

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Ruthenates (4*d* transition metal oxides) have drawn significant attention in the recent time due to many interesting novel ground states properties observed in these systems. $CaRuO_3$, a 3-dimensional orthorhombically distorted perovskite exhibits non-Fermi liquid behavior at low temperatures, while isostructural $SrRuO_3$ exhibits Fermi liquid behavior. Magnetic measurements exhibit ferromagnetic ground state in $SrRuO_3$ (Curie temperature = 165 K), which is absent in $CaRuO_3$. It is believed that the difference in Ru-O-Ru bond angle leading to significantly different electron correlation strength in these systems plays the key role in determining such drastically different ground state properties. The photoemission results in this study reveals significantly weak electron correlation strength (U/W ~ 0.2) in both $SrRuO_3$ and $CaRuO_3$, as expected in 4*d* systems. The magnetic ground state can be explained via band structure calculations using full potential linearized augmented plane wave method within the local spin density approximations. Thus, observation of non-Fermi liquid behavior in $CaRuO_3$ still remails a puzzle. Interestingly, high resolution spectra reveal particle-hole asymmetry in the excitation spectra of $CaRuO_3$ in contrast to that in $SrRuO_3$. In addition, we observe signature of strong electron-phonon coupling in the photoemission spectra of $CaRuO_3$ at finite temperatures.

We now turn to the investigation of novel properties of a 5*d* TMO, $BaIrO_3$. Highly extended nature of the 5*d*-electronic states leads to a large electron-lattice coupling, while electron correlation effect is expected to be negligible. Interestingly, $BaIrO_3$ is insulating and exhibits onset of simultaneous charge density wave (CDW) state and ferromagnetic ordering below 175 K. The high-resolution spectra reveal the existence of localized density of states at the Fermi level at room temperature, which vanish as the temperature is lowered thereby, opening a *soft gap* at E_F. To our knowledge, for the first time, we have demonstrated directly the evolution of charge density wave ground state due to the localized electronic states. In addition, we find that the spectral density of states exhibit a $(E-E_F)^{3/2}$ dependence suggesting intimate relationship between

ferromagnetic ordering and electron–lattice interactions. Ba core level spectra exhibit an unusual behavior prior to the CDW transition and pose a new question with respect to the role of precursor effects.