Rubidium Tungsten Bronze - Studied by Photoemission and X-ray Absorption

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Rubidium Tungsten oxide is a non-cuprate superconductor with Tc 2 k-7 k. Oxygen depend Tc plate was observed by transport measurement. The behavior of resistivity (ρ_{RT}) of the $Rb_{0.23}WO_y$ show the oxygen rich sample is semiconductor but the oxygen poor sample is metallic. We have measured photoemission and X-ray absorption spectrum for the $Rb_{0.23}WO_y$ at beamline 21B1 and 11A1.

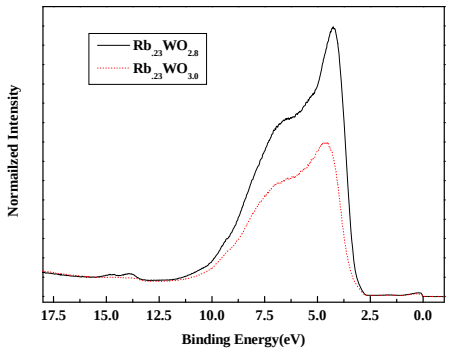

Figure 1. Normalized Valence band photoemission spectrum, high binding energy region were matched.

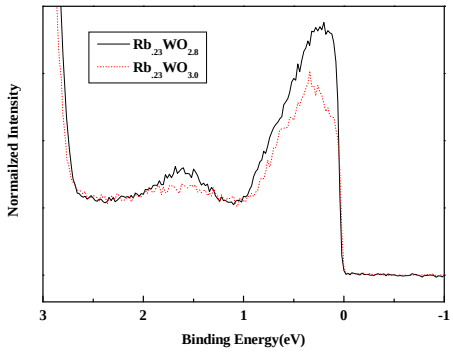

Figure 2. The conduction band and impurity state, Valence band photoemission spectrum was normalized to match high binding energy region.

In figure 1 and 2, the extended state between conduction and valence band was observed in the photoemission spectrum. The conduction band intensity is decreasing upon with the increasing of oxygen indicate the electron in conduction band was compensated by the hole from the oxygen doping. This result is consistent with the increasing of resistivity when oxygen doped.

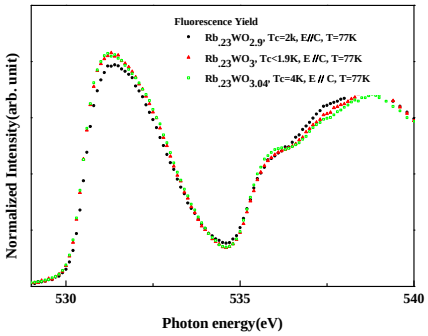

Figure 3.
Normalized oxygen *K*-edge XAS with electric field E of photon parallel to C orientation of crystal surface.

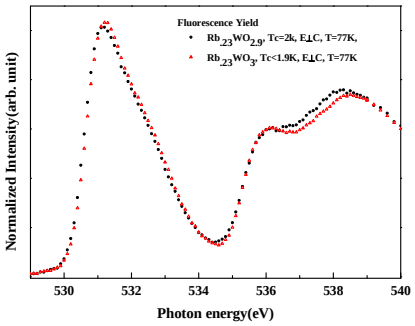

Figure 4. Normalized oxygen *K*-edge XAS with electric field of photon perpendicular to C orientation of crystal face.

The first peak of oxygen *K*-edge X-ray absorption structure (XAS) indicates the ligand hole due to the W *5d*(t_{2g} and e_g) and O *2p* hybridization. The increasing of intensity of this peak in fig. 3 E//C XAS but only slightly increase in fig. 4 E⊥C XAS indicate the increasing of hybridization state mainly on *dxz*, *dyz* orbital. The extra hole from oxygen doping fills the W *dxz* and *dyz* orbital. These result indicate the electronic structure of the host WO_y is modified significantly by varying the oxygen concentration. (The project was financial supported by National Science Council, grand no. NSC-96-2112-M-606-001-)