Investigating The Magnetic and Electronic Structure of Single Crystal $YBaCuFeO_5$ by Neutron and X-ray Scattering

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Abstract

Multiferroics has been extensively studied because it plays as an important platform for studying the cross-coupling between the different electronic degrees of freedom in the crystal space, such as spin, orbital, charge, and lattice. Using magnetization we observed that single-crystal YBaCuFeO5 (YBCFO), which growth by modified floating zone method, exhibits two antiferromagnetic transitions at T_{N1} ~ 455 K and T_{N2} ~ 175 K. Below T_{N2} the magnetic structure transforms from commensurate into an ab-spin spiral magnetic structure with a propagation vector of (H/2 K/2 L/2±δ) and the δ is depending on temperature. In addition, temperature dependence resistivity reveals that a metal to insulate transition occurs at 125 K. Elastic neutron scattering results indicates that strong magnetic coupling between different magnetic phases due to the strong interactions between Fe and Cu spins. In order to gain insight on the mechanisms of magnetic transition structures, the relation between the transition and the excitations of the electrons at d-orbitals, we proposed to perform resonant soft x-ray inelastic scattering spectroscopy (RIXS) to study the detail electronic structures as well as magnetic couplings of YBCFO.

Keywords - Magnetic Structure, INS, RXS, RIXS