

Resonant Inelastic X-ray Scattering of NiO

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The Resonant inelastic x-ray scattering (RIXS) is one of the unique techniques that have a possibility to study the dispersion relation of elementary excitations of condensed matter. Since the process of RIXS is not well understood, further study is still needed. At the previous experiment we report a RIXS study on NiO, a typical strongly correlated electron system, along the [111] direction and observed dispersion of 4eV charge transfer feature. In this experiment we have performed the RIXS experiment on NiO[100], [110] orientations to see the dispersion relation on other orientations.

The experiment was carried out on the IXS spectrometer at BL12XU. Si(551) analyser was used for the spectrometer. The total energy resolution was about 0.3eV. The NiO[100], [110] single crystal was prepared and aligned on the spectrometer.

Fig.1 and Fig.2 show the results of k-dependent RIXS experiment on NiO[100] and [110]. The spectra consisted with 0~4eV weak features (No.1 and 2) and 4~8eV strong features (No.3 and 4). Since the observed low energy features (No.1 and 2) show no dispersion at all direction, these features can be assigned as localized d-d excitation. This assignment is consistent with the optical absorption experiment that has been analysed by the cluster calculation.[1] Due to the loss energy of ~5eV, the loss energy feature No.3 was assigned as charge transfer excitation by Kao et.al.[2] Since the charge transfer state is the hybridised state of Ni 3d and O 2p bands, the dispersion of loss energy feature No.3 is the experimental confirmation of charge transfer excitation.

The theoretical calculation is still needed for detail understanding of the spectra.

[1] A. Fujimori, et.al, Phys. Rev. B **30**, 57(1984)

[2] C. C. Kao, et.al., Phys. Rev. B. **54**, 16361 (1996)

Fig.1

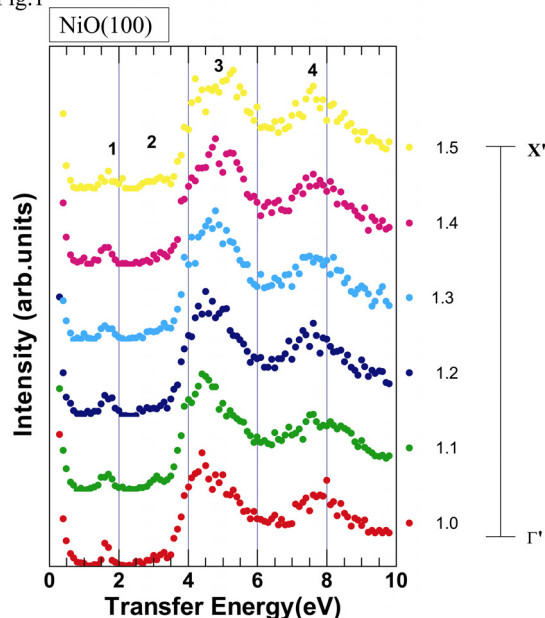


Figure 1. k-dependent RIXS spectra of NiO(100). The incident energy was at 8351eV.

Fig. 2

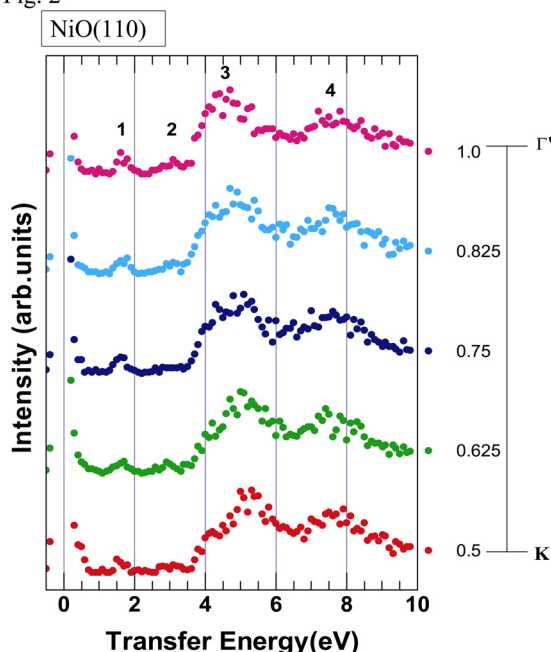


Figure 2. k-dependent RIXS spectra of NiO(110). The incident energy was at 8351eV.