Soft X-ray Absorption Studies of Charge Ordering in Intercalated Triangular Lattice Systems

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In intercalated triangular systems, rich novel phenomena exist caused by charge, spin and orbital orderings. Resonant soft X-ray scattering is expected to be a sensitive probe of the ordering in material, and can be used to elucidate the properties and the interplay of different electronic order parameters, such as the orbital, charge and magnetic long-range order. In this experiment we studied the charge ordering in iron-doped TaS_2 and alkali-doped Co-oxides with soft X-ray absorption in preparation for the future scattering work. The experiments were conducted with synchrotron radiations at NSRRC 05B3 EPU.

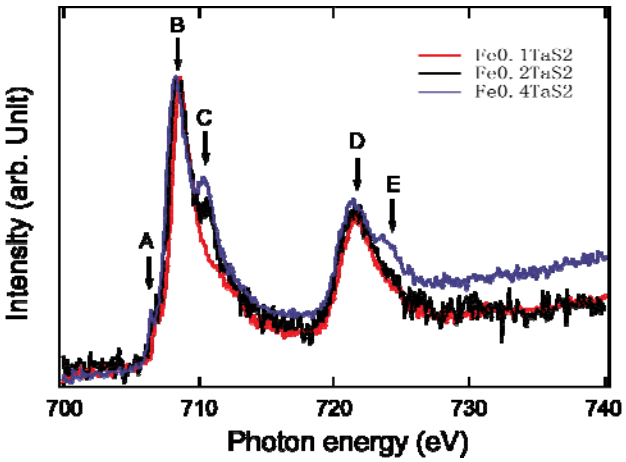

Figure 1. Soft x-ray absorption spectra of different Iron - doped dichalcogenides near Fe edge of $2p_{1/2}$ and $2p_{3/2}$. Main Features B and D are clearly observed for all the three samples with iron concentration from 0.1 to 0.4. Feature C and E come out with increased iron doping, which is related to the charge ordering of Fe atom in the material.

The spectra of the iron-doped TaS_2 near Fe edge of $2p_{1/2}$ and $2p_{3/2}$ are illustrated in Figure 1, with iron doping of 0.1, 0.2 and 0.4. Besides the coincident main features of B and D, additional features C and E arise and sharpen with increasing iron doping. Feature C and E should be related to the charge ordering of Fe atoms.

We also studied the charge ordering in the alkali-doped Co-oxides. The difference of the features on the spectra near O 1s edge and Na 1s edge are related to the charge ordering caused by alkali metal atoms. Sample quality causation for these features' difference is excluded by the complete coincidence of the spectra near Co edge (in Figure 3.), which suggests the superior quality of the three different samples.

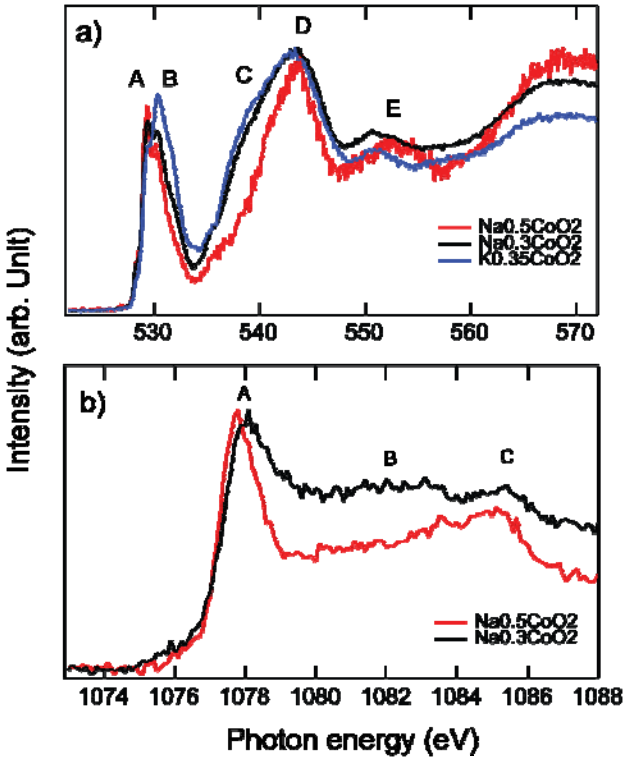

Figure 2. Soft x-ray absorption spectra of alkali metal doped Co-oxides near O 1s edge (a), and Na 1s edge (b). The differences of some features on spectra are presumably related to the charger ordering caused by different alkali metal doping.

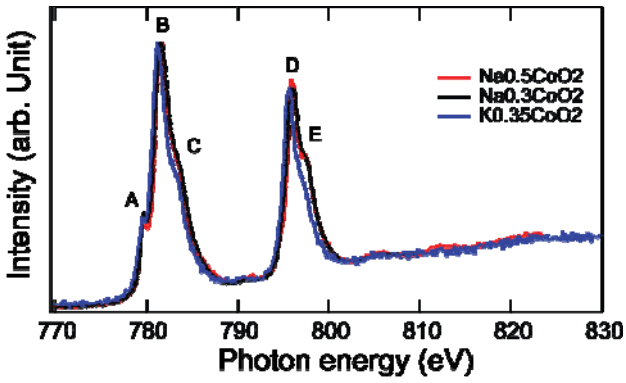

Figure 3. Soft x-ray absorption spectra of alkali metal doped Co-oxides near Co edge of $2p_{1/2}$ and $2p_{3/2}$. The complete coincidence of the different doped samples suggests the superior quality of the three samples.

These data will be further analyzed for the future experiment.