

Resonant X-ray Scattering Study of  $\beta\text{-Ag}_{1/3}\text{V}_2\text{O}_5$ 

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A series of beta-vanadium bronzes ( $\beta\text{-A}_{1/3}\text{V}_2\text{O}_5$ ) exhibits some exotic physical properties under high pressure (HP).

A basic structure is common to all  $\beta\text{-A}_{1/3}\text{V}_2\text{O}_5$  series (space group  $P2_1/a$ ). In spite of the common structure, physical properties are quite different and depend on a carrier number. When the A site is occupied by an ion having 1+ valence ( $\text{Na}^+$ ,  $\text{Ag}^+$ ...), the system shows superconductivity under HP [1]. On the other hand, when the A site is occupied by an ion having 2+ valences ( $\text{Sr}^{2+}$ ...), the system shows devil's flower-like behaviour under HP [2]. However, most of the samples (A = Na, Sr and so on) commonly show a charge ordering with  $\mathbf{b}' = 6\mathbf{b}$  unit cell at low temperature in spite of a different modulation of the charge instability above metal-insulator (M-I) transition at  $T_c$  [3]. To study an intrinsic difference among  $\beta\text{-A}_{1/3}\text{V}_2\text{O}_5$  system, we have focused upon the charge order pattern of each system.

The charge arrangement pattern of A = Na system in the  $\mathbf{a} \times 6\mathbf{b}$  unit cell has already been predicted by neutron diffraction [4] and NMR [5] measurements. The  $6\mathbf{b}$ -lattice modulation along the  $\mathbf{b}$  axis is given by the combination of the non-integer valence arrangement with the period of  $3\mathbf{b}$  and the preexistent cation arrangement with the  $2\mathbf{b}$ -lattice modulation. The valence also disproportionates among the V1, V2 and V3 sites with non-integer  $d$ -electron number. Both neutron diffraction [4] and NMR [5] measurements also predicted the existence of no- $d$ -electron site with the period of  $3\mathbf{b}$ .

Up to this point, we studied the systems of A = Na and Sr by a resonant x-ray scattering (RXS) technique. The measured spectra show quite different energy dependences, which represent that the charge order pattern of each system is different [6]. In the case of the A = Na system, the energy spectra is consistent with the charge order pattern predicted by the neutron diffraction and the NMR measurements [6].

In this experiment, we have focused on A = Ag system, which overall shows the same physical properties compared with the A = Na system except for the slight differences above  $T_c$  [3]. We have particularly interested in whether the charge arrangement pattern is the same or different from each other below  $T_c$ .

### Experimental

Experiment was carried out at BL-4C of Photon Factory. We used the RXS technique [7, 8]. The RXS intensity near main edge of V-K absorption edge (around 5.47 keV) well reflects the charge disproportionation pattern among V sites [7, 8].

### Results

Figure 1 shows energy spectra of 020 reflection as well as 0 8/6 0 reflection measured at 100 K.

Preceding study of the A = Na system, strong 0 10/6 0 reflection could be observed, however, in the case of the A = Ag system, 0 10/6 0 reflection could not be observed. Instead, weak 0 8/6 0 reflection was observed. The result represents that the charge order pattern of the A = Ag system is different from that of the A = Na system. The precise charge order pattern is now under analysis.

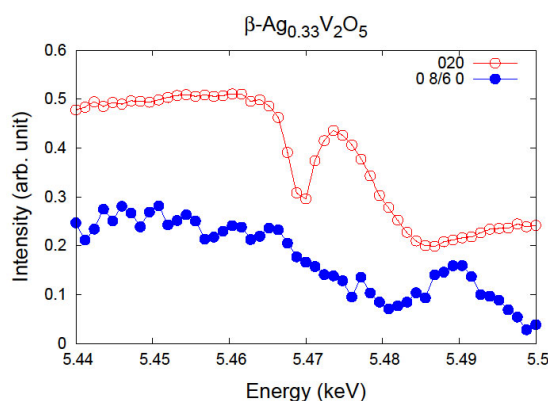


Fig. 1. Energy dependence of the intensity measured at fundamental Bragg position (0, 2, 0) and superlattice Bragg position (0, 8/6, 0).

### References

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