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Study of the electronic structure of SrFeO_{3-δ} using soft x-ray scattering

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Using resonant x-ray scattering, we report the study of electronic structures in the ion-based oxides SrFeO_{3-δ}. SrFeO₃ (SFO) has a cubic structure with an isotropic metallic behavior. The cubic perovskite SrFeO₃, in which iron is present as Fe⁴⁺, exhibits the coexistence of metallic conductivity and screw-type antiferromagnetic ordering. However, the metallic state found in SrFeO₃ becomes unstable with respect to a charge disproportionation on Fe ions due to the oxygen deficiency. In order to understand this oxidation effect, crystals with different oxygen contents were grown by floating zone furnace. For this study, a crystal was cut and pre-aligned to set the normal direction to be [0 0 1] direction. At low temperature, two satellite reflections were located to have the vectors of Q₁=(0 0 0.5) and Q₂=(0 0 0.33). The Q₁ shows a transition temperature at about 65 K in accord with the antiferromagnetic transition, but Q₂ exists even at room temperature. Both reflections display a resonance at the L₃-edge of Fe. In addition, Q₁ also shows a sharp resonance at the K-edge of oxygen, suggesting the hybridization band structure between the Fe and oxygen.

References:

- [1] S. Srinath, et. al., Phys. Rev. B 72, 54425, 2005
- [2] R. Vidya, et. al., Phys. Rev. B 74, 54422, 2006

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