

## Yb-L<sub>III</sub> edge XANES Studies on Valence fluctuation in YbIn<sub>1-x</sub>Sn<sub>x</sub>Cu<sub>4</sub>(x=0~1.0)

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### 1 Introduction

YbInCu<sub>4</sub> exhibits a first-order valence phase transition at  $T_v=42\text{K}$ [1]; the Yb valence changes from +2.9 above  $T_v$  to +2.7 below  $T_v$ [2]. The valence transition in YbInCu<sub>4</sub> is very sensitive to temperature, pressure, magnetic field and substitution. In this report, we investigate effects of substituting Sn for In on the temperature variation of Yb valence in YbIn<sub>1-x</sub>Sn<sub>x</sub>Cu<sub>4</sub> by measuring Yb-L<sub>III</sub> edge XANES spectra.

### 2 Experimental Details

Single crystal samples of YbIn<sub>1-x</sub>Sn<sub>x</sub>Cu<sub>4</sub>(x=0, 0.1, 0.5, 1.0) were made by self-flux method. They were crushed to powder, and the powdered samples were used. The XANES spectra were obtained by a transmission mode at the facilities of XAFS beam line BL-9C in PF-KEK. The XANES spectra were measured in the temperature range from 10 K to 300 K.

### 3 Results and Discussion

Figures 1 and 2 show the Yb-L<sub>III</sub> XANES spectra of YbIn<sub>1-x</sub>Sn<sub>x</sub>Cu<sub>4</sub> at 11 K and 300 K, respectively. The envelope of XANES spectrum, which is composed of divalent and trivalent Yb profiles, considerably changes for x=0.5. The result shows that the ratio of Yb<sup>2+</sup> increases with increasing the Sn content x. The Yb valence varies from +2.84 for x=0.1 to +2.49 for x=1.0 at 11 K. The effect of temperature on the Yb valence is less remarkable than that of the Sn substitution, suggesting that the valence of Yb ion is fluctuating in the whole temperature range. The peak at 8948 eV becomes less distinct for x=0.5 and 1.0, and this is probably explained by a crystal field effect[3]. It is to be added that the Yb valence of YbSnCu<sub>4</sub> is a comparatively low value of +2.5.

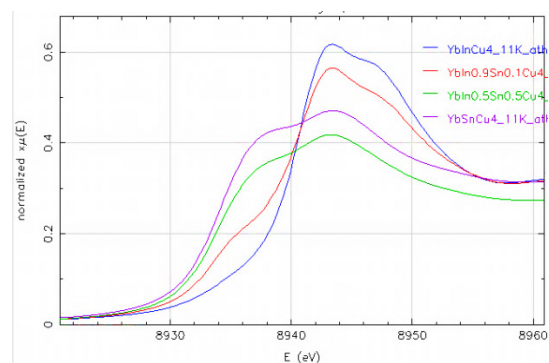


Fig. 1 Yb-L<sub>III</sub> edge of YbIn<sub>1-x</sub>Sn<sub>x</sub>Cu<sub>4</sub> at 11 K.

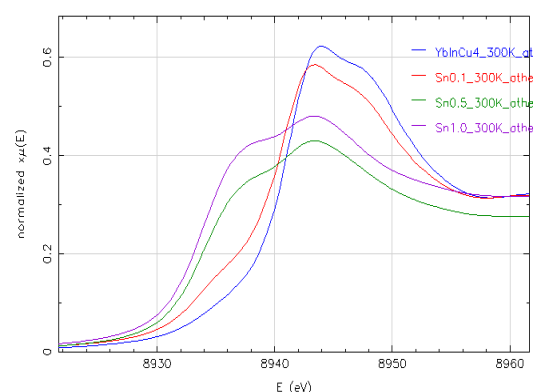


Fig. 2 Yb-L<sub>III</sub> edge of YbIn<sub>1-x</sub>Sn<sub>x</sub>Cu<sub>4</sub> at 300 K.

### References

- [1] I. Felner and I. Nowik, Phys. Rev. B 33, 617 (1986).
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