Materials Science

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Yb valence instability in Yb compounds studied by Yb-L_{III} XANES

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Introduction

The intermediate valence (*IV*) state of Yb ion has been found in many intermetallic compounds. Below certain characteristic temperature, an itinerant character of Yb 4*f* electrons appears most applicable to describe the observed physical properties. In the Yb *IV* compounds, the Yb valence is between 2+ (non-magnetic $4f^{14}$) and 3+ (magnetic $4f^{13}$), usually depending on the local environment of Yb ion. The application of external pressure is a powerful tool to tune the *IV* state; the volume reduction results in a valence +3[1]. The temperature is also an effective parameter to populate the energetically less favorable 3+ ionic state. In this report, we show the temperature dependence of Yb valence in Yb_2Au_2In compound by measuring the Yb-L_{III} edge XANES spectra.

Experimental Details

Polycrystalline ingots of ternary Yb compounds were prepared by arc-melting the constituent elements in Ar atmosphere. Subsequently, they were crashed to powder. The XANES spectra were obtained by a transmission mode at the facilities of XAFS beam-line BL-12C in PF-KEK. The sample temperature was controlled from 30 to 300 K.

Results and Discussion

Figure 1 shows the Yb-L_{III} XANES spectra of Yb_2Au_2In, which could be fitted satisfactorily with two WL profiles. At 36 K and 254 K, temperature independent trivalent component of about 45 % intensity is observed. This is in disagreement with the statement that the compound shows stable divalent Yb ion [2]. It may be hard to assume that the sample contains trivalent Yb component as much as 45 %. Further work is necessary to study the Yb valence instability in the compound.

It is also noted that the fitting was not good at the higher energy above 8.95 keV. This could be explained either multiple scattering effects or a crystal field splitting of Yb-5d states.

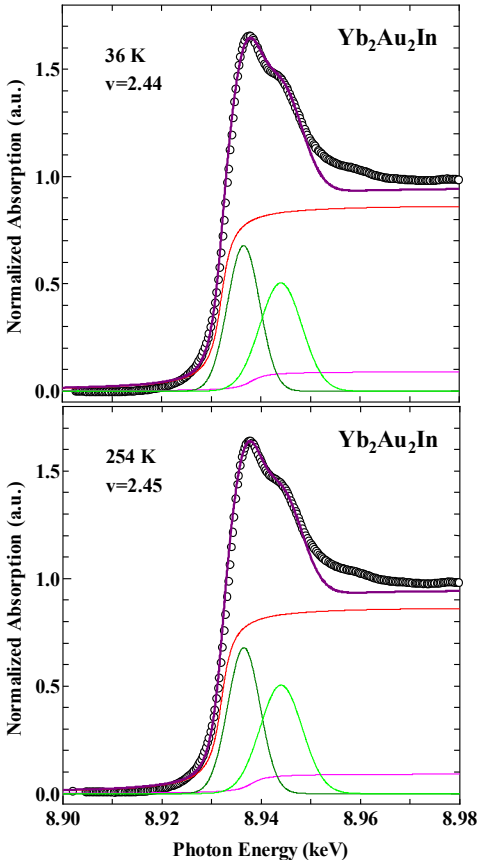

Fig. 1: Yb-L_{III} edge x-ray absorption of Yb_2Au_2In at T = 36 K and 254 K.

References

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