Threshold excitation of V Kβ

Jun KAWAI*[1], Shingo HARADA[1], Ippei KISHIDA[1], Toshiaki IWAZUMI[2], Rintaro KATANO[3], Yasuhito ISOZUMI[4], Hironobu SHOJI[5], Susumu NANAO[5]
[1]Department of Materials Science and Engineering, Kyoto University, Kyoto 606-8501, Japan
[2]KEK-PF, Tsukuba, Ibaraki 305-0801, Japan
[3]Institute for Chemical Research, Kyoto University, Uji, Kyoto 611-0011, Japan
[4]Radioisotope Research Center, Kyoto University, Kyoto 606-8501, Japan
[5]Institute of Industrial Science, University of Tokyo, Meguro-ku, Tokyo 153-8505, Japan

Introduction

Kβ spectra of 3+, 4+, and 5+ vanadium compounds are measured at K edge threshold (5465 eV) excitation. Raman shift and narrowing of the fluorescent line are observed. Though the normal X-ray fluorescence spectra have a broad line width due to the life time effect, the threshold excitation spectra reveal fine structures due to the narrow width of the spectra.

Experimental

Samples measured were vanadium (III) acetylacetonate $(CH_3COCHCOCH_3)_3V$, vanadyl (IV) acetylacetonate $(CH_3COCHCOCH_3)_2VO$, and vanadium (V) oxide V_2O_5. These three chemicals were in powder form. The nominal electron configuration of these compounds were d^2 (III), d^1 (IV), and d^0 (V).

Spectra were measured using "Escargot" spectrometer on the beamline BL-7C. The analyzing crystal was curved InSb(333) crystal and the detector was a position sensitive proportional counter. Time required to obtain one spectrum was about one hour and two or three iterations of measurements were performed to check the reproducibility.

Results

Chemical shift of the $K\beta_{1,3}$ peak is shown in Fig. 1. Resonant Raman scattering spectra and X-ray fluorescence spectra of vanadyl (IV) acetylacetonate are shown in Fig. 2, where 5630, 5550, 5500 eV (solid lines), 5470, and 5465 eV excitation spectra are plotted. Narrowing of 5470 eV excitation spectrum and the Raman shift of 5465 eV spectrum are found. The Raman spectra of vanadium (III) acetylacetonate were split into two peaks as is shown in Fig. 3. Detailed discussion has been published in Ref.[1].

Reference

[1] J. Kawai et al., Adv. X-Ray Chem. Anal. Japan, 32, 125 (2001).

* jkawai@process.mtL.kyoto-u.ac.jp

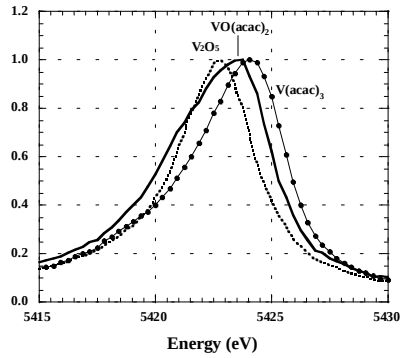

Fig.1 Chemical shift of three vanadium compounds.

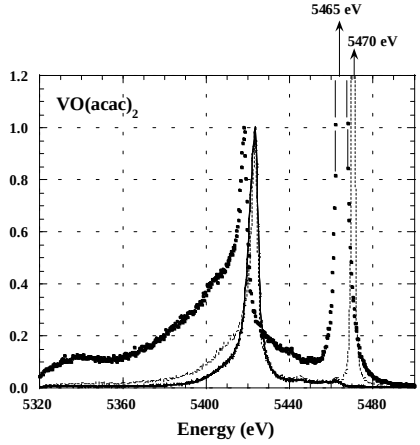

Fig.2 Resonant X-ray Raman spectrum of vanadyl (IV) acetylacetonate.

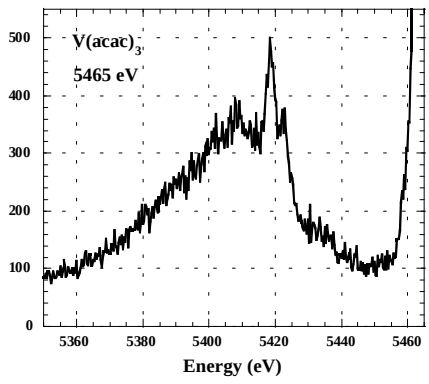

Fig.3 Resonant X-ray Raman spectrum of vanadium (III) acetylacetonate at 5465 eV excitation.