Resonant X-ray Raman scattering spectra of Sm-compounds

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Resonant X-ray emission spectroscopy (RXES) provide more important information than X-ray absorption spectra (XAS) or X-ray emission spectra (XES) about the intermediate and final states of 4f rare-earth compounds. In this study, we observed the RXES spectra of Sm compounds, SmB_6 and Sm_3Ce_4, which are considered to be mixed valence states by hopping of f electron between 2^+ and 3^+. We measured RXES of Sm_3Se_4 by using the crystal monochrometer "ESCARGOT" at the beam line BL-7C of Photon Factory, KEK, Tsukuba.

Figure 1 (a) shows the Sm L_{III} XAS of Sm_3Se_4. The RXES were taken at selected excitation energies showed by vertical arrows for 1 to 17 in (a) are represented in Fig.1 (b). The intensity of each spectrum is normalized with an incident photon flux. The emitted photon energies (ω_s) were studied across the Sm L_{III} absorption threshold as a function of the transfer energy ($\omega_i - \omega_s$). In this representation , the resonant Raman peak B_1 and B_2 are fixed for various values of ω_i and its intensities go though resonant maximum at the absorption shoulder (Spectrum No.7) and absorption peak (Spectrum No.11).Across the absorption peak, normal L_α emission peak appears and shift linearly with incident photon energies. The intensity of these peaks is almost constant in this energy region. A structure A is so weak that we can't observe it in Fig.1 (b).

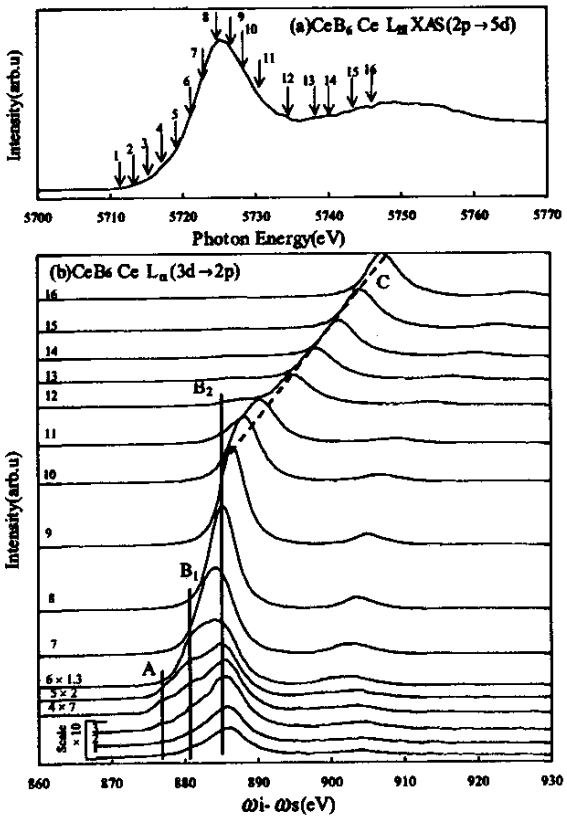

Fig. 1 (a) Sm L_{III} XAS of Sm_3Se_4, (b) SmL_α RXES for Sm_3Se_4 exited with different photon energies, as indicated by arrows in (a). The vertical line and the dashed line are used for a guide to the eye. The line B_1 and B_2 shows the peak position of Raman spectra where stays a constant energy transfer ($\omega_i - \omega_s$). The line C shows the peak position of normal L_α emission spectra where shifts continuously with incident photon energy (ω_i).

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