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, SmB6 and Sm3Ce4, which are considered to be mixed valence states by hopping of f electron between 2+ and 3+. We measured RXES of Sm3Se4 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 Sm3Se4. 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 (ωs) were studied across the Sm LIII absorption threshold as a function of the transfer energy (ωi - ωs). In this representation, the resonant Raman peak B1 and B2 are fixed for various values of ωi 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 Lα 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 LIII XAS of Sm3Se4, (b) SmLα RXES for Sm3Se4 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 B1 and B2 shows the peak position of Raman spectra where stays a constant energy transfer (ωi - ωs ). The line C shows the peak position of normal Lα emission spectra where shifts continuously with incident photon energy (ωi).

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