

Pressure-induced Valence Change of the Thulium in TmTe

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The valence state of Tm in TmTe is divalent. It was shown by compressibility to undergo a transition from 2+ to 3+ as increasing the pressure from 2 to 6 GPa. We investigated the electronic structure of Tm in TmTe for pressures up to 10.6 GPa in both screwing and unscrewing modes by X-ray Absorption Spectroscopy in the Partial Fluorescence Yield (PFY-XAS) and Resonant X-ray Emission Spectroscopy (RXES), working at the Tm *L_{III}* edge. Compared with the measurements performed in december 2004, hydrostatic conditions were maintained throughout the experiment. In addition, a more accurate pressure calibration was obtained by using a smaller ruby ball.

In the PFY-XAS spectra series presented in Figure 1, the 2+ component (~8644 eV) is observed to gradually decrease while the 3+ component (~8651 eV) grows over the pressure increase. The spectrum obtained at 10.6 GPa shows similarities with the TmS one. The Tm valency is therefore deduced to increase with pressure up to a nearly trivalent state at 10.6 GPa. An abrupt change in the spectrum shape, observed between 6.6 and 7.2 GPa, is believed to be related to the cubic to tetragonal phase transition. An emission spectrum was taken at the 2+ resonance with an incident energy of 8644 eV at every pressure step. The corresponding series, shown in Figure 2, looks consistent with the PFY-XAS spectra.

The fitting of the spectra will be processed soon so as to quantify the valency.

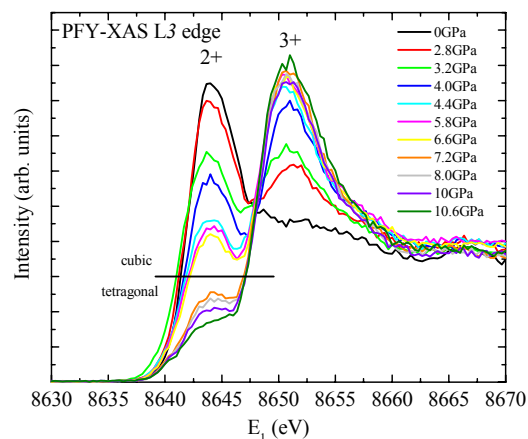


Figure 1. PFY-XAS spectra obtained at several pressures in the screwing mode..

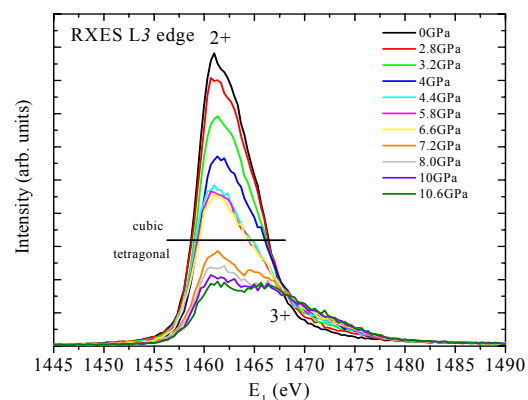


Figure 2. RXES spectra obtained at the 2+ resonance for several pressures in the screwing mode.