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Synchrotron radiation for study Fano type photoemission resonances in rare earth atoms

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The synchrotron radiation is a strong intensity source of continuous radiation in the wide range of energy starting from infrared, visible range, vacuum ultraviolet, soft X-ray and hart X-ray up to several hundreds thousands of eV. It gives possibility to study effects in chosen range as a function of continuous scale of energy. The paper presents application of the radiation in the range from 100 to 200 eV obtained duo to monochromator Flipper II with 6 diffraction grids mirrors. In the range of energy the optical transition edges occur for rare earth metal atoms $4d^{10} – 4f^{n}$. It gave as a chance to measure photoemission spectra containing 4f electrons and to obtain corresponding to it Fano resonance. Results permit to determine parameters of Fano type resonant curve. Remarkable maximum in resonant energy highly increases sensitivity to recognize small amount of measured 4f electrons contribution to the spectra. As the resonant energy is different for different valences of ions (high correlation effects for highly localized f orbitals) the experiment helps to distinguish between the valences of the rare earth metal in the sample. The results will be concern to Gd, Eu and Sm [1] atoms.

References

[1] E. Guziewicz, B.A. Orlowski, B.J. Kowalski, I.A. Kowalik, A. Reszka, L. Wachnicki, S. Gieraltowska, M. Godlewski, R.L. Johnson, *Appl. Surf. Sci.* **282**, 326 -334 (2013).

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High energy photoemission spectra of crystals with local structure - application of synchrotron radiation

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The synchrotron radiation was used to measure Tunable High Energy Photoemission Spectra (THE-XPS) at a wiggler beam line station BW2 (DORIS, HASYLAB, DESY, Hamburg) with energy range from 2.4 to 10 keV, monochromatic photon flux $5x10^{12}$ photons/s and energy resolution of 0.5 eV. The set of ternary crystal $Pb_{1-x}Cd_xTe$ spectra contain valence band and core level electrons: Cd 4*d*, Pb 5*d*, Te 4*d*, Pb 4*f*, Pb 4*d*, Cd 3*d* and Te 3*d* electrons.

The introduction of Cd ion on a sit of Pb ion in PbTe rock salt crystal leads to the creation of ternary crystal e.g. $Pb_{0.94}Cd_{0.06}Te$ [1] still with the rock salt structure. As the Cd ion radius is smaller than Pb ion radius it can lead to the increase of Cd – Te and Pb – Te distance in these region of crystalline local structure created around Cd ion. These crystalline local structure leads to the appearance of electronic local structure at these region. The spectra of samples indicate existence of the local electronic structure in the ternary crystal.

References:

[1] B.A. Orlowski, A. Szczerbakow, B.J. Kowalski at al., *J. Elec. Spec. Rel. Phen*.**184** (2011) 199.