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Time-Resolved Luminescence Spectroscopy of Wide Gap Insulators under VUV Excitation at MAX IV and PETRA III Storage Rings

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The international luminescence community is in an excellent situation concerning the experimental conditions for research of wide gap materials under VUV excitation. The FinEstBeAMS beamline at MAX IV equipped with a moveable luminescence end-station is in operation since 2019 [1]. The luminescence end-station of the P66 beamline at PETRA III has in permanent user operation since 2022. Although many technical features and solutions are analogous, there are several relevant distinct features from a user's point of view. The FinEstBeAMS beamline has a grazing incidence (GI) optical scheme providing a high photon flux > 1011 ph/s in the energy range of 4.5 –1000 eV from an elliptically polarizing undulator source. The P66 is built on a dipole magnet source with a 2 m NI monochromator equipped with Al and Pt coated gratings [2]. It operates in the energy range of 3.7 –40 eV with photon flux < 1010 ph/s for Al and < 109 ph/s for Pt grating, respectively. Also, the focal spot sizes are typical for undulator and dipole magnet beamlines, being of nearly 0.2 x 0.2 mm and 4 x 0.5 mm slit shape, respectively. Thus, the samples studied at FinEstBeAMS are exposed to the incident radiation at much harsher conditions leading to their degradation and luminescence fading during the measurements. On the other hand, a suppression of higher order radiation due to GI is a bigger challenge for the FinEstBeAMS than for P66 beamline. The typical time resolution achieved ⊠ 180 ps is comparable for both setups, but it is available only in a single bunch mode (time interval 320 ns) at MAX IV and in a timing mode (40 bunches at 192 ns intervals) at PETRA III. Such peculiarities must be taken into account while planning photoluminescence research at different beamlines.

Our research team investigates the properties of wide gap materials for various applications at both facilities. The wide gap fluoride scintillators are of interest for ultrafast timing applications due to intrinsic cross- and intraband luminescence [3]. The UV-C emissions of Pr3+ ions have also wide range of applications from increasing efficiency of radiotherapy in medicine to novel light sources for various purposes. In order to fulfil the expectations set by the applications, the basic relaxation processes of excitations populating Pr3+ states have been studied in various hosts [4, 5]. Our contribution will focus on findings in the studies of the above-mentioned wide gap materials by time-resolved luminescence and other methods at the P66 and FinEstBeAMS beamlines.

References

[1] V. Pankratov, R. Pärna, M. Kirm, et al., Radiation Measurements 121 (2019) 91–98.
[2] S. I. Omelkov, K Chernenko, J. C. Ekström, et al., J. Phys.: Conf. Series 2380 (2022) 012135.
[3] J. Saaring, A. Vanetsev, K. Chernenko, et al., J. Alloys Compd. 883 (2021) 160916.
[4] J. Kappelhoff, J.-N. Keil, M. Kirm, et al., Chemical Physics 562 (2022) 111646.
[5] I. Romet, É. Tichy-Rács, K. Lengyel, et al., J. Luminescence 265 (2024) 120216.

I plan to submit also conference proceedings

Yes

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