**A Role of Large Scale Facilities in the Development of Novel Functional Materials**

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Large scale research facilities, synchrotron radiation centres, have played a crucial role in fundamental discoveries and in the development of novel functional materials. This is thanks to advancing experimental methods based on superior radiation properties of storage ring based light sources. Namely, high brilliance of the radiation, specific time structure in ns-time domain and wide energy range from IR to hard X-rays are available for various experiments. In my talk, I will focus on the materials research carried out using time-resolved luminescence spectroscopy under VUV-XUV excitation at various research centres like DESY (Hamburg, Germany) [1] and MAX-IV Lab (Lund, Sweden) [2].

Synchrotron radiation has been an indispensable tool in the investigation of such short-wavelength emissions as cross-luminescence (CL) with ns decay and 5d-4f emission of rare earth ions [3]. Recent advances in band structure calculations, high demand on ultrafast scintillators for various applications and advancements of photodetectors (e.g., SiPM-s) with sensitivity shifted towards UV have renewed interest to such ultrafast emitters. Multication fluorides with complex band structure, e.g., K2SiF6, exhibit CL in UV-VUV and even visible regions as shown by us using pulsed cathodoluminescence. The studies at storage rings can provide a deep insight into the relevant processes challenging for ultrafast scintillation applications. A particular topic of the synchrotron studies of wide band gap nanomaterials is aimed at understanding the influence of nano-particle size and morphology on the fundamental electronic properties in comparison with bulk materials (see [4] for Al2O3). The peculiarities revealed via the excitation spectra of various intrinsic and extrinsic emissions in nano-alumina will be discussed. Finally, research challenges and experimental potential for luminescence spectroscopy at the FinEstBeAMS of the MAX IV Lab will be reviewed.

References

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