LUMINESCENCE SPECTROSCOPY AT MAX IV

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The tunability of synchrotron radiation and its inherent well-defined time structure makes it particularly well suited for photoluminescence studies. Vacuum ultraviolet (VUV) luminescence spectroscopy is a powerful tool for the study of electronic structure not only in any classes of wide band gap materials [1, 2] but even in nanocrystalline semiconductor structures [3] and two-dimensional systems [4].

With a circumference of 96 m and an electron energy of 1500 MeV, new MAX IV storage ring at MAX IV-lab (Lund, Sweden) is a perfect synchrotron source for VUV and soft x-ray (XUV) photon generation. Luminescence spectroscopy experiments is going to be performed in one of the branches of FinEstBeaMS beamline, which is developed by a consortium of Finnish and Estonian Universities. The FinEstBeaMS will use elliptically polarizing undulator light source, which produces soft x-rays of a variable polarizations with high flux and delivers radiation covering the photon energies between 4 and 1000 eV. The beamline optics is based on the collimating plane grating monochromator, which will provide high precision photon energy tuning over wide energy range. After monochromator a switching mirror unit will be placed to direct the radiation alternately into two brunch lines; one of them will be equipped by the luminescence endstation.

For photoluminescence spectroscopy, a set-up consisting of an ultra-high vacuum chamber with close cycle cryostat for measurements in the UV, VUV and XUV range was constructed and developed in our groups. To analyse photoluminescence in the UV to near IR range (200 to 1500 nm), a 300 mm Shamrock imaging spectrometer equipped with a Newton CCD (Andor) and several photomultiplier detectors (Hamamatsu) is coupled to an optical fibre, collecting emission from the sample. Options for time-resolved measurements are limited due to the time structure of the storage ring with small circumference (only ~10 ns between pulses). The possibility of high-resolution excitation scanning and the option to change polarisation of the incident light by adjusting the undulator phase make this beamline very attractive for the field of luminescence studies under VUV and XUV excitation.

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[3] V. Pankratov et al., Physical Review B **83,** 045308 (2011)
[4] V. Pankratov et al., Journal of Physics: Condensed Matter **28,** 015301 (2016)