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A Transition Edge Sensor Spectrometer at BESSY II for Impurity Level X-ray Absorption and Emission Spectroscopy of Solid State and Molecular Systems

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A new experimental setup, which includes a highly photon sensitive spectrometer based on superconducting transition edge sensors (TES) is under commissioning at BESSY II. The setup is dedicated to XAS, XES and RIXS experiments in the soft X-ray regime with a strong emphasis on the study of low concentration systems, which can be divided into two main themes: 1) solids and low dimensional systems and 2) molecular systems in solution. The principle of a TES detector is based on the abrupt normal metal superconductor transition edge of a superconducting sensor as an energy dispersive and ultrasensitive photon detector with a collecting efficiency orders of magnitude higher than grating-based spectrometers [1,2]. The present detector consists of an array of 256 sensors in a compact design mounted on a closed-cycle dilution refrigerator to reach the operation temperature of 53 mK, and targets an energy resolution of 0.5 eV FWHM for energies below 1 keV. The experimental setup is installed at the UE52-SGM beamline with full polarization control. The relatively large (1-6 mm 2) beam size at the sample position allows low sample damage measurements of fragile systems. The dedicated UHV sample chamber is designed for the preparation of low-dimensional solid state systems as well as for the insertion of molecular systems in frozen solutions.

In this presentation, after an introduction on the principle of the TES technology, I will show the specific characteristics of the spectrometer deployed at BESSY II and the results of the first tests with the full experimental setup.

I plan to submit also conference proceedings

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