SOLEX: A COMPREHENSIVE TOOL FOR ENERGY-DISPERSIVE DETECTORS CHARACTERIZATION

Y. Ménesguen[1], M.-C. Lépy[1]
[1]*CEA, LIST, Laboratoire National Henri Becquerel, F-91191, Gif-sur-Yvette, France*

Today, available experimental facilities, like monochromatic radiation (tunable X-ray source or synchrotron), should offer new perspectives of experimental measurements and give new possibilities to improve detector characterization.

The SOLEX facility [1] developed at the French metrology Institute for ionizing radiation (Laboratoire National Henri Becquerel) produces a tunable monochromatic X-ray beam in the 0.5-28 keV range. This is basically an X-ray tube used with a dispersive crystal to produce a monochromatic beam, either from the characteristic lines or from the Bremsstrahlung radiation emitted. The tube is windowless and is placed inside a vacuum chamber together with the crystal. It runs in Johann geometry and the tube, the crystal and the exit slit are placed on a Rowland circle of 20 cm of radius.

SOLEX has been equipped with a rotation system, thus the same monochromatic beam can be successively sent towards two different directions. The second output is equipped with a gaseous proportional counter of which the attenuation of the front and back Be windows as well as the Ar+CH4 gaseous mixture had been measured in order to estimate the absolute photoabsorption efficiency. This detector is used as a reference to calibrate the efficiency of any energy-dispersive detectors. An automatic procedure running under a LabView® program allows energy-scan efficiency calibration.

Because of the monochromatic character of the beam, a complete study of the response function can be performed by selecting the incident energy. This is of special interest around the binding energies of the constituting elements of the detector, since the thickness of these can be accurately determined by examining the discontinuity gap. Moreover a surface scan of the detector can be performed using an X-Y motorization of the mounted outputs.

SOLEX is also equipped with a motorized holder for filters so as to characterize their transmission. This was used to measure the mass attenuation coefficients as well as the fluorescence yields of several transition metals [2].

[1] C. Bonnelle, P. Jonnard, J.-M. André, A. Avila, D. Laporte, H. Ringuenet, M.-C. Lépy, J. Plagnard, L. Ferreux, J. C. Protas, *Nuclear Instruments & Methods in Physics Research A*, **516** (2004), 594 – 601.

[2] Y. Ménesguen and M.-C. Lépy, "Mass attenuation coefficients in the range $3.8 < E < 11$ keV, K fluorescence yield and K_β/K_α relative X-ray emission rate for Ti, V, Fe, Co, Ni, Cu, and Zn measured with a tunable monochromatic X-ray source", *Nuclear Instruments & Methods In Physics Research B*, **268** (2010), 2477-2486.