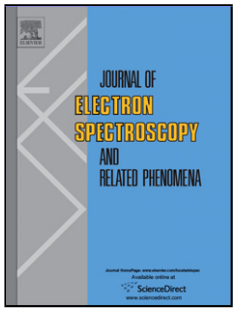

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XPS spectrometer transmission function optimization by the differential evolution algorithm

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Highlights

- An XPS containing XSAM 800 setup, produced by KRATOS, was upgraded
- Acquisition and control systems, which were reconstructed, are now PC-based
- A sample-biasing method for transmission function measurement was introduced
- The novel method is superior to the well-established first principles method
- The transmission function was optimized by the differential evolution algorithm

An XPS containing XSAM 800 setup, produced by Kratos, was upgraded. This mainly included the reconstruction of the acquisition and control systems. The detection system non-linearity, and the transmission function of the upgraded system were measured. The dead time of the detection system was determined using two independent approaches, which provided practically the same result. The knowledge of the detector dead time allows us to anticipate the count rate loss. The transmission function was measured using the well-established first principles method. Since this approach did not provide satisfactory results for all pass energies, a novel procedure, here denoted as sample-biasing method, was proposed and successfully applied. The novel approach is much faster, and significantly reduces the measurement error as compared to the first principles method. The transmission function was then optimized by applying a differential evolution algorithm, which provided its relative increase in the range from 10 % to 110 % depending on the fixed analyzer transmission mode and the electron