

# HIGH-RESOLUTION SOFT X-RAY EMISSION SPECTROMETRY EMPLOYED FOR THE DETERMINATION OF ATOMIC FUNDAMENTAL PARAMETERS RELATED TO THE Ni L- FLUORESCENCE PROCESS

M. Müller<sup>1</sup>, B. Beckhoff<sup>1</sup>, und B. Kanngießer<sup>2</sup>

<sup>1</sup> Physikalisch-Technische Bundesanstalt, Abbestr. 2-12, 10587 Berlin, Germany

<sup>2</sup> TU Berlin, Institut für Optik und Atomare Physik, Hardenbergstr. 36, 10623 Berlin, Germany

The reliability of XRF quantitation, in particular its reference-free variant [1], strongly depends on the knowledge of the respective atomic fundamental parameters such as fluorescence yields, transition probabilities and Coster-Kronig coefficients. For an accurate XRF analysis, e.g. involving light matrix elements or transition metal nanolayers, a reliable determination of these parameters in the soft X-ray range with small uncertainties is essential. Measurements based on calibrated instrumentation employing energy-dispersive detectors can very well contribute to the determination of atomic fundamental parameters [2]. However, the energy resolution of energy-dispersive detectors is not sufficient to determine all parameters of interest, especially for the L-fluorescence lines of transition metals. Hence, a wavelength-dispersive grating spectrometer (WDS) was designed and built for dedicated experiments at the plane grating monochromator beamline for undulator radiation of the PTB at the electron storage ring BESSY II. The WDS was experimentally characterized with respect to both its detection efficiency and response functions. This characterization allows for absolute measurements of fundamental parameters with small relative uncertainties [3].

As an example, we present a study of the L-fluorescence emission of Ni and the related fundamental parameters such as Coster-Kronig coefficients and sub shell fluorescence yields. Taking advantage of the tunable monochromatized undulator radiation, we could study the evolution of the Ni-L emission spectra with increasing incident photon energy. In particular, specific spectral features such as resonant inelastic X-ray scattering (RIXS) and satellite lines show strong dependencies with respect to the photon energy of the exciting radiation.

## References:

[1] B. Beckhoff, R. Fliegau, M. Kolbe, M. Müller, J. Weser, G. Ulm, *Anal. Chem.* **79**, 7873 (2007)

[2] M. Müller, B. Beckhoff, G. Ulm, B. Kanngießer, *Phys. Rev. A* **74**, 012702 (2006)

[3] M. Müller, B. Beckhoff, R. Fliegau and B. Kanngießer, *Phys. Rev. A* **79**, 032503 (2009)