

Table-top soft X-ray spectroscopy of TiO_2 with a reflection zone plate on a curved substrate

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We report on recent experimental results from wavelength-dispersive soft X-ray spectroscopy of TiO_2 around the Ti La line at 452.16 eV, performed with an innovative, laboratory-scaled setup. Excited by electrons with an energy of 4.4 keV, the micron-sized ($\approx 10 \mu\text{m}$) fluorescence and bremsstrahlung emission is dispersed by a reflection zone plate (RZP) on a spherical substrate (Table 1).

Table 1: Parameters of the RZP (design energy E_0) on a curved substrate with radius R_M . Entrance and exit arm length are denoted by $R'_1,2$ and corresponding grazing angles are named as α_0 and β_0 .

E_0	R'_1	R'_2	α_0	β_0	R_M
458.6 eV	838 mm	2500 mm	2.59°	4.11°	28.62 m

Its figure error with an amplitude of $\pm 0.12 \mu\text{m}$, as measured by 2-D interferometry (SIOS GmbH), is compensated via diffractive wavefront correction for optimal spectral resolution. The RZP is fabricated using laser writing and provides with the laminar profile a diffraction efficiency around 25 %. The signal is detected with a CCD camera (greateyes “BI UV1”), whose 2048 \times 515 pixels record the spectrum with an effective spatial resolution of $\approx 25 \mu\text{m}$. Several peaks such as Ti $\text{L}_{1,1}$ around 400 eV, Ti La and $\text{L}_{\beta 1,6}$ just above 450 eV,

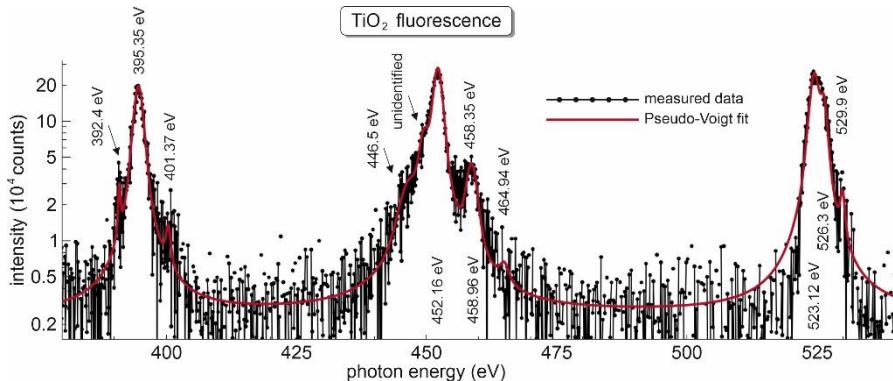


Figure 1: Measured spectrum of the TiO_2 target with identified peaks in the range (380 – 540) eV.

O $\text{K}\alpha$ near 524 eV and Ti $\text{L}_{\beta 3,4}$ below 530 eV can be identified, as shown in Fig. 1. The energy resolving power $E/\Delta E$ varies between 190 and 260, while the signal-to-noise ratio is estimated for the 3 main peaks from Fig. 1 to 475 ± 42 .