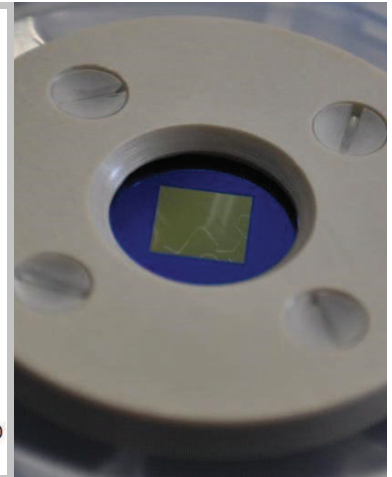
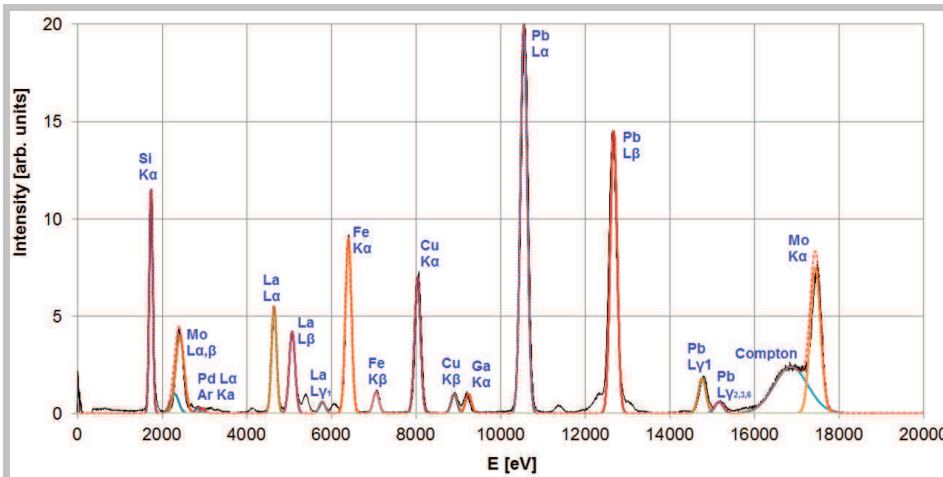


Thin film XRF reference samples



Energy spectrum of a 6-element reference sample RF17 measured with a lab TXRF using Mo-K radiation (50 kV excitation). The energy range is covered with peaks of comparable intensity. *(The Ga peak is caused by the internal TXRF standard.)*

Element content:

The reference samples contain the 6 elements **Pb, La, Pd, Mo, Cu, and Fe**, plus **Si** and **N** from the silicon nitride membrane. Further, they may contain traces of C, Ar or other contents of ambient air that are not important for most XRF measurements. Different element depositions may be available on request.

* In sample series prior to RF17, Ca is included, too.

Element	Mass dep. C0 / C10 (ng/mm ²)	Emission lines [eV]		
		Kα	La	Ma
Pb	7.6 / 84.9	74163	10541	2346
La	11.7 / 121.4	33298	4649	833
Pd	1.5 / 23.3	21123	2838	
Mo	0.8 / 8.6	17444	2293	
Cu	2.0 / 22.2	8040	930	
Fe	3.9 / 43.9	6401	747	
Si	Substrate	1740		

Advantages of thin film XRF reference samples:

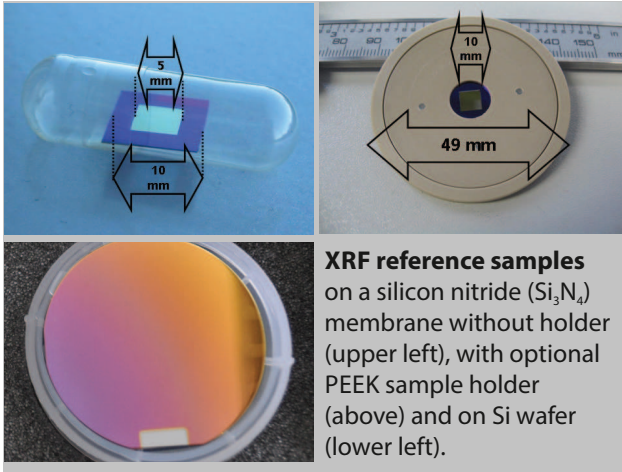
- Absorption free standard: no matrix correction necessary
- Substrate thickness of 200 nm permits transmission measurements, low background from substrate
- Mass depositions in the range of ng/mm² (few atomic layers) permit quantification without the need to interpolate from higher values
- Uncertainty ≤ 1 ng/mm² (1 atomic layer)
- Wide selection of non-overlapping XRF lines, exact calibration curve, many points over large energy range
- Signal strength easily adjustable by thickness, similar intensity for all elements
- High degree of uniformity & homogeneity (better than 1% for the full sample area)
- Application for adjustment of confocal μ-XRF is possible
- Wide range of available elements (standard and tailored compilations)

Mass deposition:

Mass deposition on the samples ranges from ~1 ng/mm² to ~120 ng/mm² for the elements listed in the table for standard mass version C0 and high mass version C10. The mass deposition values listed here are average values measured by AAS, ICP-OES and XRF. A data sheet with actual values is delivered with each individual reference sample.

Despite the very precise measurements these reference samples are no "Certified Reference Materials (CRMs)".

Thin film XRF reference samples



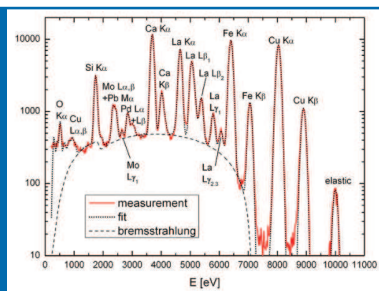
XRF reference samples on a silicon nitride (Si_3N_4) membrane without holder (upper left), with optional PEEK sample holder (above) and on Si wafer (lower left).

Sample dimensions:

The reference samples are available in different designs: Glued into a circular PEEK holder for easier handling or as a small silicon frame. Available frame sizes are $5 \times 5 \text{ mm}^2$ or $10 \times 10 \text{ mm}^2$ with a 200 nm thin usable area of $2 \times 2 \text{ mm}^2$ or $5 \times 5 \text{ mm}^2$ in the center. The PEEK holder is 3 mm thick with an outer diameter of 30 mm or 49 mm . Other sizes are available on request.

In addition to this, the reference sample elements can be coated onto $2''$ diameter wafers or square wafer pieces ($18 \times 18 \text{ mm}^2$).

Energy spectrum of a 7-element reference sample measured at HZB/BESSY in co-operation with PTB Berlin at 10 keV . Many emission lines are visible between 0.5 keV and 10 keV .



Attention:

Due to its very small thickness, the Si_3N_4 membrane is *extremely fragile* and must be handled with care. Store it in the box as delivered in a dry, clean place because dust or any contaminations cannot be removed. *Never expose it to air blow, tension, stress or strong vibrations. Never wipe, touch or scratch the surface.*

	Large area map SF1	μ beam "mapping" S10
Energy	26 keV	9.5 keV
Area	$15 \times 15 \text{ mm}^2$	$1.2 \times 1.2 \text{ mm}^2$
Beam size	$0.8 \times 0.4 \text{ mm}^2$	$2.8 \times 12 \mu\text{m}^2$
Step size	$0.8 \times 0.4 \text{ mm}^2$	$\sim 30 \times 30 \mu\text{m}^2$
Cu $\text{K}\alpha$		
La $\text{L}\alpha$		

Lateral homogeneity:

The lateral homogeneity of all elements deposited on these reference samples has been tested with μ -XRF mappings. The deviation is smaller than 1% over the entire sample area.

Product numbers:

Reference samples on 200 nm thick silicon nitride (Si_3N_4) membranes. Size: $2 \times 2 \text{ mm}^2$ in $5 \times 5 \text{ mm}^2$ frame or $5 \times 5 \text{ mm}^2$ in $10 \times 10 \text{ mm}^2$ frame, with mass deposition C0 (standard) or C10 (high) without PEEK holder:

- RF - 200 - 0205 - C00 - X
- RF - 200 - 0205 - C10 - X
- RF - 200 - 0510 - C00 - X
- RF - 200 - 0510 - C10 - X

Reference samples on 200 nm thick silicon nitride (Si_3N_4). Membrane size: $5 \times 5 \text{ mm}^2$ in $10 \times 10 \text{ mm}^2$ frame with PEEK holder (30 mm or 49 mm diameter):

- RF - 200 - 0510 - C00 - P30
- RF - 200 - 0510 - C10 - P49
- RF - 200 - 0510 - C00 - P30
- RF - 200 - 0510 - C10 - P49

Reference samples on $2''$ (50 mm) diameter wafer or $18 \times 18 \text{ mm}^2$ wafer piece:

- RF - SI - 0050 - C00 - X
- RF - SI - 0050 - C10 - X
- RF - SI - 0018 - C00 - X
- RF - SI - 0018 - C10 - X