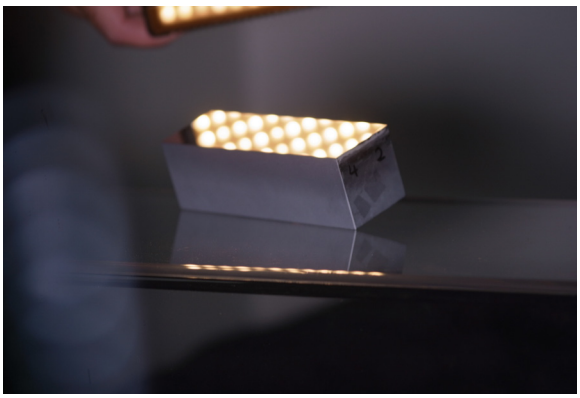
Multilayers

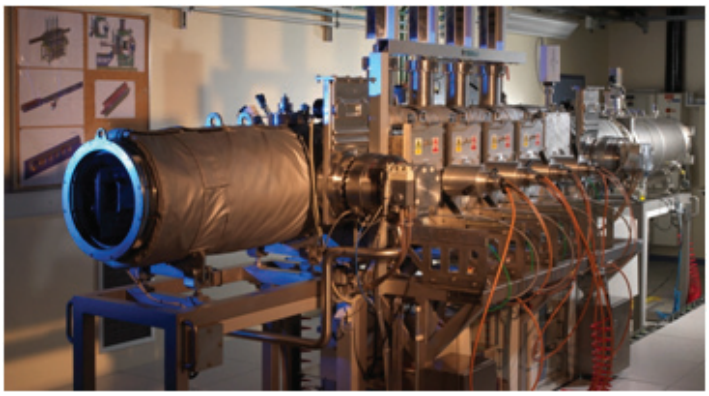
The ESRF Multilayer Facility has developed a strong expertise in the use of multilayers as X-ray optical elements. Today, they are deployed on a considerable number of ESRF beamlines, mainly as focusing devices and monochromators. The key assets of these devices are the following:

- **High reflectivity and large bandwidth**
- **Wide photon energy range**
- **Large dimensions**

Manufacturing process

Multilayers (MLs) are produced by sputter deposition in a gas discharge. Particles ejected from a target form thin layers on a substrate that is moved in front of it. Both uniform or graded layer thicknesses can be generated. ML stacks with d-spacings as low as 2 nm and hundreds of periods can be manufactured.



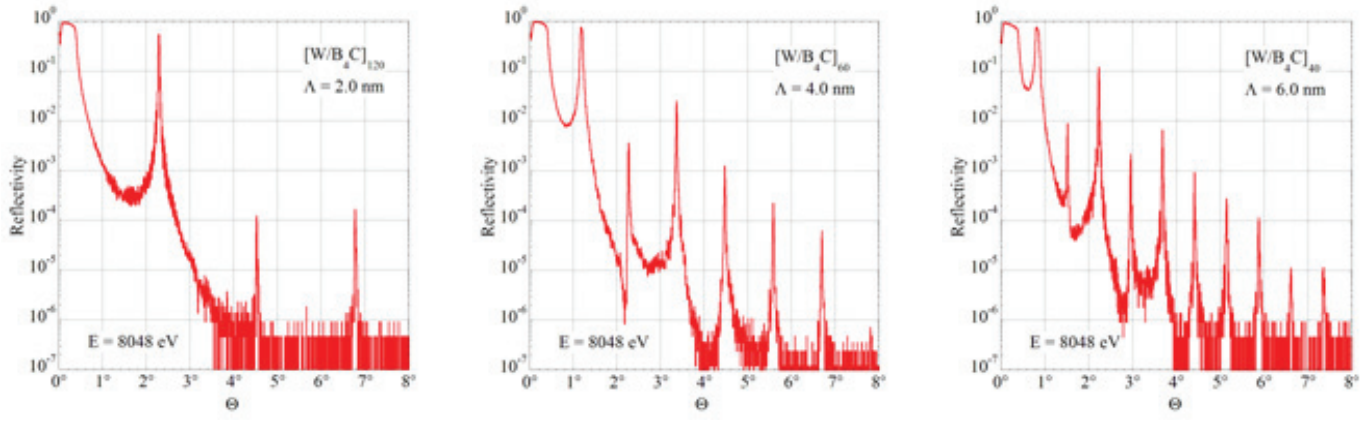


Characteristics

Peak reflectivity	*Bandwidth*	*Photon energy*	*Maximum dimensions*
50 to 90%	*1 to 10%*	*5 to 100 keV*	*1000mm(L) x 150mm(W) x 100mm(H)*

Experimental results

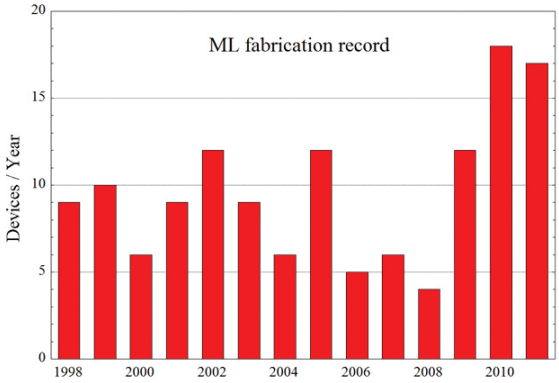
X-ray reflectivity of W/B4C MLs – example of a "popular workhorse" on many ESRF beamlines



X-ray reflectivity data at E = 8048 eV of W/B4C MLs with d-spacings of Λ = 2.0, 4.0, and 6.0 nm. High reflectivity and visibility of higher reflection orders indicate ordered stacking and sharp interfaces.

Our expertise in X-ray multilayer optics

The ESRF X-ray Optics Group can provide expertise in the design, the manufacture and the characterisation of multilayer devices. The ESRF Multilayer Laboratory has developed a robust and precise coating facility [1] that has produced almost 150 devices since 1998. It has contributed to the successful implementation of KB focusing optics with sub-60nm resolution and a photon flux of 1012 ph/s [2]. The majority of ESRF beamlines are equipped with multilayer-based optical devices.



Publications

[1]: The new ESRF multilayer facility: progress and perspectives, AIP Conf. Proc. 1234 (2010) 720-723
[2]: Dynamically figured mirror system for high-energy nanofocusing at the ESRF, Proc. SPIE 8139-04 (2011)