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.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>50 to 90%</th>
<th>1 to 10%</th>
<th>5 to 100 keV</th>
<th>1000mm(L) x 150mm(W) x 100mm(H)</th>
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Experimental results

X-ray reflectivity of W/B\textsubscript{4}C MLs – example of a “popular workhorse” on many ESRF beamlines

![Graphs showing X-ray reflectivity data at E = 8048 eV of W/B\textsubscript{4}C MLs with d-spacings of \( \Lambda = 2.0, 4.0, \) 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

[2]: Dynamically figured mirror system for high-energy nanofocusing at the ESRF, Proc. SPIE 8139-04 (2011)