A W/B_4C multilayer phase retarder for broad-band polarisation analysis of soft x-ray radiation

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Soft x-ray synchrotron radiation with variable polarisation is a sophisticated probe of the physical properties of matter. Many of the most advanced experiments take advantage of the inherently high degree of linear and/or circular polarisation of such a source which is in general an elliptical undulator. Polarimeters designed to deliver the four Stokes parameters of a source rely on a phase retarder and analyser in combination. Because of the enhancement of the multilayer performance near absorption edges most multilayer phase retarders have been designed to be used near the 2p absorption edges of the constituting materials (Mo/Si, Cr/C, Cr/Sc, Ni/Ti, and Ni/V). Thus these optical elements are monoenergetic in the range between 100 eV and 600 eV. At best they can operate at two distinctive energies (e.g. Sc 397 eV and Cr 550 eV).Here we show the performance of a W/B_4C phase retarder designed to work from ~600 eV to ~850 eV. This range was previously not accessible for circular polarisation analysis. The measured phase shift is constant over this photon energy range – indicating that an optimised W/B_4C multilayer design would be an excellent "non-resonant" phase retarder for soft x-ray polarimetry in the range of the 2p edges of Fe, Co and Ni, where most of the polarisation-sensitive magneto-optical investigations are being carried out.

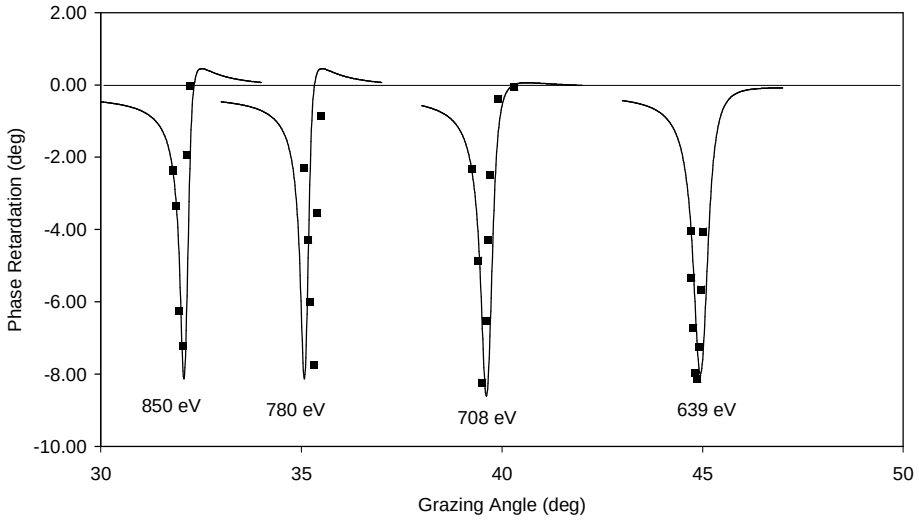

Figure 1. Calculated (line) and measured (points) phase retardation for a W:B_4C multilayer at various photon energies. The data were taken with the BESSY polarimeter [1] at the elliptical undulator UE56/2

1. F. Schäfers et al., Applied Optics **38**, 4074-4088 (1999)