Narrow-band Borrmann multilayer filters for monitoring of EUV sources

Jonathan Barreaux[1,*], Bert Bastiaens[1], Igor Kozhevnikov[3], Fred Bijkerk[2] and Klaus Boller[1]

[1]Laser Physics and Nonlinear Optics, MESA+ Institute for Nanotechnology, University of Twente, Enschede, The Netherlands

[2]XUV Optics, MESA+ Institute for Nanotechnology, University of Twente, Enschede, The Netherlands

[3]Institute of Crystallography, Russian Academy of Sciences, Leninsky Prospect 59, Moscow 119333, Russia

*j.l.p.barreaux@utwente.nl

EUV sources currently under development for high volume manufacturing are based on hot plasmas that produce next to 13.5 nm also broadband blackbody radiation and out-of-band line emissions.

For the accurate monitoring of the in-band (13.5 nm ± 2%) radiation power, narrow-band-pass filters are required. Standard filters such as absorptive thin layers can provide neither very narrow bandwidths, nor wavelength selectivity.

We propose an approach based on the Borrmann effect applied to multilayer stacks. This effect relies on the matching of the standing wave field within the multilayer stack with the structure: the minima of the wave field intensity are placed in the center of the absorbing layers, resulting in a resonant decrease in absorption and a narrow-band transmission spectrum for a specific wavelength.

We show calculated transmission spectra of Borrmann filters optimized for different bilayer materials, bandwidths, transmissions and wavelengths.