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XUV multilayer mirrors

Normal incidence XUV mirrors specifically adapted to the experimental parameters are key components for e.g. attosecond pulse generation, X-ray lasers or other (quantum) optic setups. Our design know-how and application experience enables us to provide support for the planning of your setup. The physical principle of XUV multilayer mirrors is based on the interference of scattered XUV radiation from each interface of a multilayer stack of metal and (non-)metal layers (Figure 1). The realization of multilayer optics for steering, spectral filtering and dispersion control of (sub-)femtosecond XUV/soft X-ray pulses are based on broad-bandwidth (a-)periodic multilayer systems of binary or ternary stacks of nanolayers, with atomically smooth interfaces, of various materials, with layer thickness ranging from 1 to 10 nm and layer numbers ranging from ~10 to ~1000 (Please see reference [1] for more details).

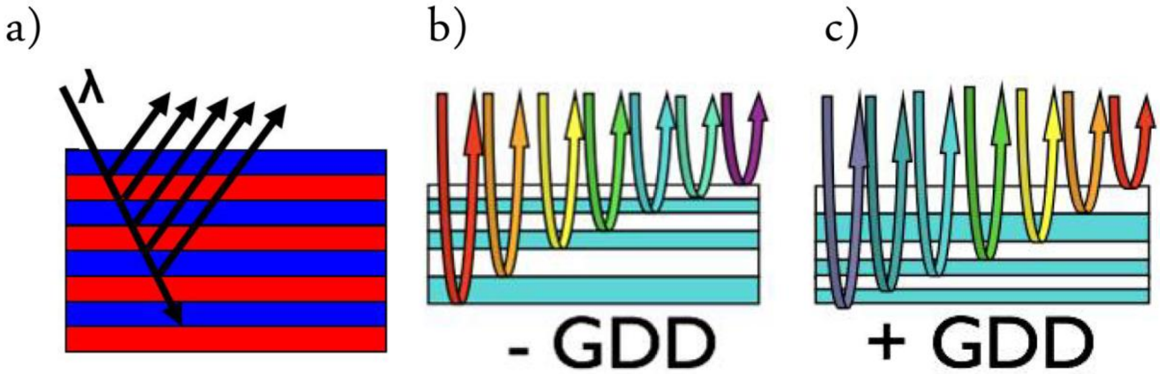

Figure 1: a) Physical principle of a XUV multilayer mirror for a strong periodic mirror, enabling a nearly gaussian reflectivity and nearly chirp free spectral phase. In case of necessarily phase corrections one can use aperiodic mirrors introducing a negative group delay dispersion b) or a positive one c).

Advanced simulation and optimization of the amplitude and phase characteristics of the multilayer coatings precedes the coating process and atomic precision ion beam deposition provides high accuracy coating layers. This enables us to control the temporal and spectral properties of the pulses in the XUV/soft X-ray range upon reflection from the multilayer optics with very high precision in wavelength and spectral phase as well as high efficiency. The maximum reflectivity, bandwidth, central energy is dependent on your requirements but can be addressed in the currently accessible energy range from 20 to 180 eV. XUV measurements confirm our realization and simulation process (Figure 2a), being measured on double mirrors which are used e.g. in attosecond streaking experiments (Figure 2b).

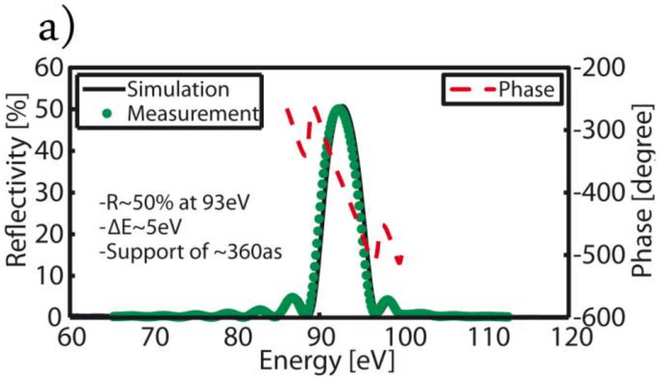

Figure 2: a) Simulation and XUV reflectivity measurement, together with the simulated phase evolution, for the XUV93eVBW5eV mirror design, supporting ~360 as pulses. b) Image of a coated XUV double mirror with a core diameter of 5mm for e.g. IR/XUV time delay experiments being used for attosecond streaking.

With our XUV mirrors, customers have realized attosecond pulses with a pulse duration of 80 as [2] or determined the time delay of the photoemission of two certain electron wave packets [3].

Reference:

[1] M. Hofstetter et al., "Attosecond dispersion control by extreme ultraviolet multilayer mirrors," Optics Express **19**(3), 1767-1776 (2011).
[2] E. Goulielmakis et al., "Single-cycle nonlinear optics," Science **320**(5883), 1614-1617 (2008).
[3] M. Schultze et al., "Delay in Photoemission," Science **328**(5986), 1658-1662 (2010).

Recommended mirror designs:

XUV93eVBW5eV