Development of efficient and stable Al-based multilayer reflecting coatings for EUV range

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A further progress in scientific and industrial applications of multilayer optics in the extreme ultra-violet range (EUV) requires a high efficiency, specific spectral shape and good stability of multilayer coating as well as some new optical functions such as a control of phase and polarization of reflected EUV radiation.

Laboratoire Charles Fabry (LCF) has been involved in development of multilayer optics since more than 35 years (both theoretical and experimental studies). For instance, in the field of space applications, the EUV multilayer coatings for imaging telescopes of several solar missions were designed, fabricated and characterized. There were the telescopes of SOHO, STEREO and Solar Orbiter (to be launched in 2018 [1]). The latter is realized with Al/Mo/SiC multilayer coatings.

In the last PXRMS conference in 2010 we presented the first results of studies of multilayers made with the use of aluminum as a low absorbing material beyond 17 nm. A significant increase of the measured reflectance of periodic multilayers was obtained by applying a three-material design for the multilayer structure [2]. Here we will report on the progress achieved since then in the development and fabrication of Al-based multilayer coatings for EUV applications in the spectral range between 17 and 40 nm. We will discuss the design of various multilayer structures which is performed by using the IMD simulation software [3] and/or a home-made Matlab code with optimization algorithms. We will describe how complex multilayer systems can be designed and optimized for specific applications in the EUV range.

We will present and discuss the structural parameters and optical performance of periodic and aperiodic Al-based multilayer systems that have been designed and produced in our laboratory. Most of the multilayer mirrors were deposited by magnetron sputtering and characterized by grazing incidence x-ray (GIXR) and EUV reflectivity. The EUV reflectivity measurements were performed at the BEAR beamline of ELETTRA Sincrotrone Trieste and at the metrology beamline of Soleil synchrotron.

References

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