



1. Title:	Mo/Si multilayers capped by TiO ₂
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3. Abstract body:

The lifetime of Mo/Si multilayer-coated projection optics is one of the outstanding issues on the road of commercialization of extreme-ultraviolet lithography (EUVL). A serious problem of Mo/Si multilayers capped by silicon is the considerable reflectivity degradation due to carbonization and oxidation of the silicon surface layer under exposure by EUV radiation. The instability of Mo/Si multilayers becomes especially critical at elevated pressures of water vapor and hydrocarbons, thus noticeably limiting the application time of Si-capped Mo/Si multilayers. A number of solutions have been recommended in the past, including the use of different protective capping layers (ruthenium and carbon). As a result, the lifetime of EUV multilayer coatings was noticeably improved but still doesn't meet stringent commercial tool specifications.

In this study, we focus on titanium dioxide (TiO₂) as promising capping layer material for EUVL multilayer coatings. The multilayer design as well as the deposition parameters of the Mo/Si system with TiO₂ capping layer was optimized in terms of maximum peak reflectivity at a wavelength of 13.5 nm and long-term radiation stability. The synchrotron irradiation at the NIST with average power density of 5 mW/mm² and different vacuum conditions was used for optimization. Finally, the reflective properties and long-term radiation stabilities of Mo/Si coatings with TiO₂, Ru and C capping layers were compared. The major results of the comparative study, Out of Band (OOB) reflectivity, and photo-catalytic behaviour will be presented and discussed in this paper.