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State of the art optics for Extreme Ultra-Violet Lithography (EUVL) is based on Mo/Si multilayer mirrors (MLMs) integrated with diffusion barriers and capping layers to increase the optics lifetime and experimental reflectance (the current record being 71.3%[1]). In this work, we focus on interface thermodynamics control as a method to optimize the MLM performance. We develop a general framework to select potential elements that could be used as additives in the Si spacing layer to suppress intermixing, while ensuring high EUV reflectivity. We identify rubidium (Rb) as the material giving the highest MLM reflectance and we provide a rigorous estimation of the EUV optical properties of its silicide compounds, Rb_nSi_m. We show an increase in optical contrast between Rb_nSi_m and Mo via a negative shift of the Si L-edge, and a negligible effect on the absorption coefficient, that remains low. Our calculations indicate that intermixing with Mo can be reduced by 82% and a maximum reflectance of 73.9% can be achieved. Provided that the optics for EUVL must function in a hydrogen environment, we calculate the reflectance also for MLMs with RbH and $RbSiH_3$ as spacing layers. For Mo/RbH MLMs we estimate a full suppression of intermixing and a 74.8% maximum reflectance, while for Mo/$RbSiH_3$ MLMs, if integrated with RbH diffusion barriers, a superior value of 77.4% can be achieved.
By implementing the proposed MLM solutions we predict that the optics lifetime can be enhanced and that the total EUVL throughput can be increased up to a factor 2 [2].

[1] E. Louis , A.E. Yakshin, T. Tsarfati, F. Bijkerk, "Nanometer interface and materials control for multilayer EUV-optical applications", Progress in Surface Science 86 (2011) 255-294.

[2] A. Saedi, J. W. M. Frenken, C. Sfiligoj, J. Verhoeven, “Multilayer reflector, method of manufacturing a multilayer reflector and lithographic apparatus”, WO 2017076694 A1 (2016)