

Surface nanolayer chemistry in multilayer mirrors

Surface chemistry, segregation and silicide formation of extreme ultra-violet (EUV) Mo/Si mirror surfaces is being studied with low energy ion spectroscopy (LEIS) and angular resolved x-ray photoelectron spectroscopy (ARXPS). The reflective optics, to be used in EUV lithography, may suffer from photo-catalytic surface carbon growth, oxidation, and layer intermixing under high photon flux.

Protective d-metal capping layers, in combination with carbon re-hydrogenation and oxidation with various radical species are applied and analyzed in situ with mass spectroscopy and in vacuo with ARXPS. A distinction in cleaning efficiency for different carbon species on various caps as well as reduction of the metal oxide is observed. The noble d-metals used as cap yield broad interfaces, and a B₄C buffer layer is applied to suppress diffusion.

Cap material agglomeration is observed at the front of the next Si/Mo interface. Thermodynamics of the interfaces are being investigated, and it is proposed that the interface front is Mo-depleted Mo-silicide which acts as a precursor for noble d-metal silicide formation.