

Cleaning of tin-drop contaminated EUV optics by initiation of phase transformation

N. Böwering

Bökötech and Bielefeld University, Bielefeld, Germany

In tin-based EUV light sources the mirrors for light collection and drive laser deflection are often contaminated with thick deposits of tin, requiring periodic optics cleaning. A new cleaning concept for tin-drop contaminated optics based on the initiation of tin pest, the allotropic phase transformation from white to gray tin is presented.

In a severe contamination scenario, molten tin of high purity is dripped onto multilayer-coated mirror samples. After inoculation with gray tin seed particles the smooth tin drops undergo the phase transition during cooling of the samples to below $-24\text{ }^{\circ}\text{C}$. The tin drops disintegrate in a few hours due to strong volume expansion with simultaneous embrittlement and can then be easily removed from the samples without any coating damage. The reflectance of multilayer-coated EUV mirrors at 13.6 nm is found to decrease by no more than 1% with this cleaning method. In addition to ex-situ tests, in-situ cleaning schemes in a vacuum chamber are described.