



1. Title:	Essential procedures for endurance testing of multi-layer mirrors
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3. Abstract body:

Extensive EUV-irradiation endurance testing of Ru-capped multilayer mirrors (MLMs) performed at the NIST synchrotron facility has revealed that the rate of reflectivity degradation does not always depend on the exposure conditions in an intuitive way. We will present results of recent exposures of Ru-capped MLMs in the presence of water and various admixtures of carbonaceous gases. The dependence of damage rate on both water partial pressure and EUV intensity can be dramatically influenced by relatively small partial pressures of carbon-containing species. Due to these effects, the spatial distribution of mirror damage does not always reflect the Gaussian intensity distribution of the exposure beam. This can lead to substantially more reflectivity loss in the wings of the EUV-beam distribution than in the center where the intensity is highest. We will also discuss how the bandwidth and time structure of the incident EUV radiation may affect the rate of reflectivity-degradation. In addition to high-resolution reflectometry of the EUV-exposure sites, the results of surface analysis such as XPS will be discussed. Although the observations presented here are based on exposures of Ru-capped MLMs, unless novel capping layers are similarly characterized, direct application of accelerated testing could significantly overestimate mirror lifetime in the production environment.