

Wide-range reflection multilayer for normal-incident optics in the 200-25nm region

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In EUV region, the working wavelength range of normal incidence optical systems has been limited above 40nm, because normal incidence reflectances of usual mirror-materials are small below 40nm. Therefore, the development of multilayers working range in shorter wavelength region has been made [1, 2]. In this study, new high reflectance mirrors with the short wavelength limit of 25nm are designed and fabricated improving the previous one [2].

A conceptual structure of the wide-range multilayer is composed of a top-single-layer (TSL) reflecting light in the 200–65nm region, a middle-aperiodic-layers (MAL) reflecting light in the 65-25 nm region, and a bottom piled-double-layers (PDL) reflecting light around 25 nm. Measured reflectance of the fabricated wide-range multilayer for an angle of incidence of 5° is compared with those of the usual coating materials in Fig. 1 (a). Obtained reflectance of the multilayer is designated as the solid curve, and simulated reflectances of the materials, as the broken curves. The measured reflectance is comparable with that of Pt in the 200–35nm region and is higher than any materials in the 35–25nm region. Measured reflectance is also compared with the simulation results of the designed multilayer in Fig. 1 (b). The reflectance is lower than that of simulation in the 200–62nm region, which suggests that the fabricated thickness of the TSL layer (SiC) is thinner than the designed one. The reflectance is comparable with the simulation in the 62–41nm and 31–23nm regions. These results suggest that the layer structure of the fabricated PDL fulfills the designed one. The reflectance in the 41–31nm region is lower than the simulation, and this may be caused by the difference of the optical constants between the fabricated Y_2O_3 and/or Mg layers in MAL and the data used in the simulations [3].

References

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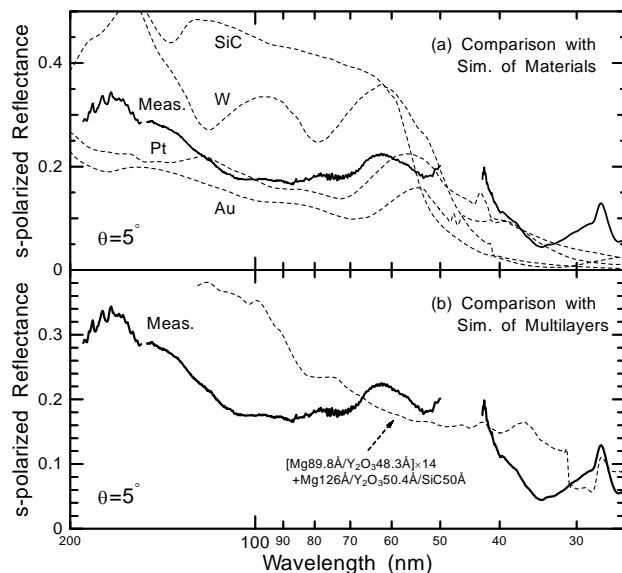


Fig. 1: Measured reflectance of the wide-range reflection multilayer compared with reflectances of SiC, W, Pt, and Au (a), and with simulated one (b).