Measurements of the Refractive Index of Mo for Multilayer Mirror Applications

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We are currently witnessing an increasing amount of activity in areas such as EUV/soft x-ray lithography, which requires accurate determination of the complex refractive index n, essential for the design of optical components. Sum rule tests demonstrate defects in the available experimental data for n in the 1993 atomic tables for materials that are important in multilayer mirror applications, such as Mo. Transmission measurements in the range 60 - 930 eV for the determination of the optical constants of Mo are presented in this work. The new measurements yield improved values for the absorption in the range 11 - 14 nm, which is the region of operation for normal incidence Mo/Be and Mo/Si multilayer mirrors. A complete set of absorption data in the range 1 - 30,000 eV is formed with the new results and previously published values, and the Kramers-Kronig relations are applied for the real part of the refractive index. The sum rules show that the deficiencies in the values of the absorption coefficient in the 1993 tables are corrected and that the new set of optical constants is self-consistent. The new values for the refractive index of Mo are used to calculate normal incidence reflectivities and to fit measurements of Mo-based multilayer mirrors. The results presented have been used in order to revise the optical constants for Mo which are available on the World Wide Web (*http://www-cxro.lbl.gov/optical_constants*).