

E.4: Characterization of spectropolarimeter test mirror samples using Indus-1 reflectivity beamline

To study the coronal magnetic field in the solar atmosphere, an extreme ultraviolet (EUV) spectropolarimeter is proposed by Indian Institute of Astrophysics (IIA), Bengaluru for wavelength range of 50–100 nm (24.8–12.4 eV). The proposed spectropolarimeter will be used to measure the degree of linear polarization and the orientation of the polarization vector associated with the EUV emission from the solar corona. Using the Hanle effect, the measured polarization information will be used to study the vector magnetic fields of solar corona.

The EUV spectropolarimeter will comprised of a set of reflective mirrors, mirrors are set in Brewster's angle geometry. Theoretical analyses suggest the platinum coated EUV mirror has a good polarization power and high reflectivity (> 40%). Platinum-coated test mirror samples fabricated using a DC sputtering setup at the CeNSE laboratory, Indian Institute of Science (IISc), Bengaluru, were tested at the reflectivity beamline which provides the soft x-ray and VUV photons in the energy range of 10 to 300 eV with an energy resolution ($E/\Delta E$) ~200-500. Both angle and energy dependent reflectivity measurements were performed in s and p polarization geometry to experimentally determine the Brewster angle and corresponding reflectivity of Pt coated test mirror samples. The experimental results obtained so will be used for validation of platinum coated mirrors for EUV solar spectropolarimeter applications by IIA group. Inside view of the beamline goniometer setup arranged in p-polarization geometry for EUV reflectivity experiments is shown in Fig. E.4.1.

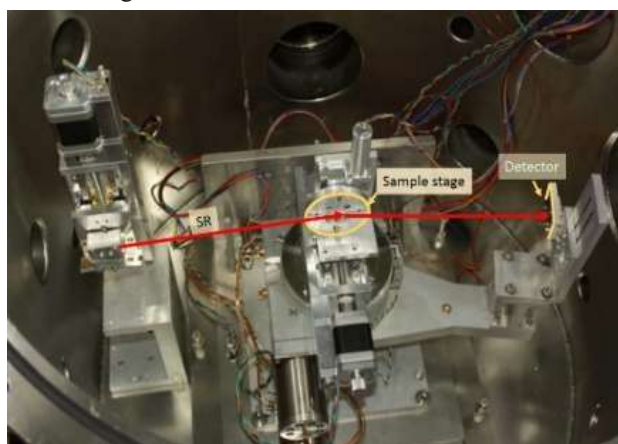


Fig. E.4.1: Inside view of the BL-04 experimental station setup in p-polarization geometry.

Measured Energy dependent reflectivity curves for s- and p-polarized radiation near the Brewster angle are shown in Fig. E.4.2. The experimentally obtained R_s and R_p demonstrate strong polarization performance and show good agreement

with Zemax simulations, confirming the suitability of platinum coatings for EUV polarimeter mirrors. R_s and R_p reflectivities are also compared with Werner et. al [1] and Windt et. al [2] results (Shown in Fig. E.4.2).

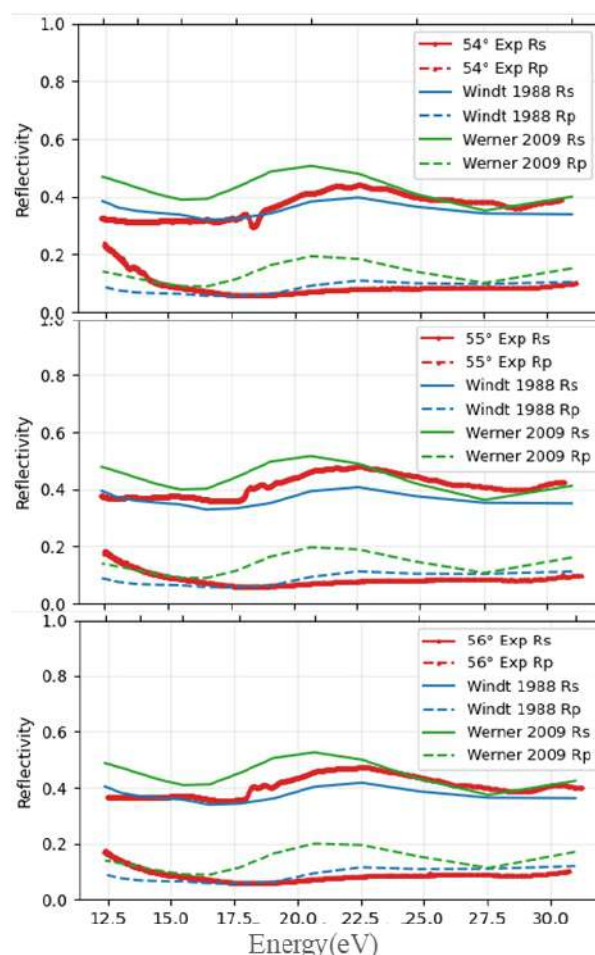


Fig. E.4.2: s and p-polarized x-ray reflectivity of Pt mirror measured at Indus-1 reflectivity beamline (BL-04) near the Brewster angle (54°, 55° and 56°) are shown along with earlier reported data from literature.

Courtesy: Savitha MS & K. Nagaraju, IIA, Bengaluru.

References:

- [1] Wolfgang S.M. Werner et. al, Optical constants and inelastic electron scattering data for 17 elemental metals. J. Phys. Chem. Ref data 38. 1013-1092 (2009).
- [2] David L. Windt et. al, Optical constants for thin films of Ti, Zr, Nb, Mo, Ru, Rh, Pd, Ag, Hf, Ta, W, Re, Ir, Os, Pt and Au from 24 to 216 Å. Applied Optics Vol. 27 No.2, 246-278 (1988).

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