fitted results, as a function of wave vector transfer. By considering interlayer model in Fe-Si system, values of thicknesses and roughnesses for pure Fe, pure Si layer and interlayer were obtained. Interlayer forms due to the strong interdiffusion of Fe and Si into each other. Thickness of interlayer is related to the depth of interdiffusion. Roughness of interlayer is related to the uniformity of interdiffusion. Obtained thickness of interlayer is ~13Å with 4-6Å roughness in each case. This indicates that interlayer formation at Si/Fe interface is independent from the Fe and Si layer thickness. After this interlayer formation no further interdiffusion takes place across Si/Fe interface.

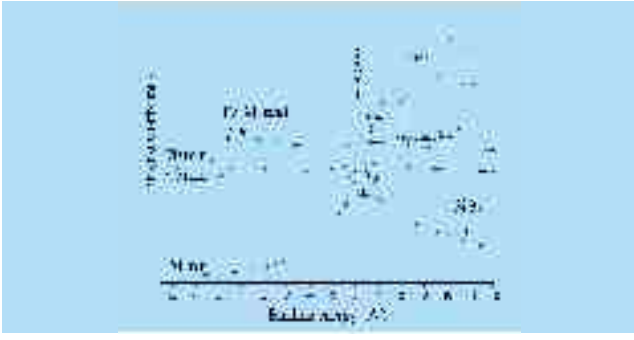

Fig. A.3.1 *Depth profile valence band spectra of bilayer taken at synchrotron Indus-1.*

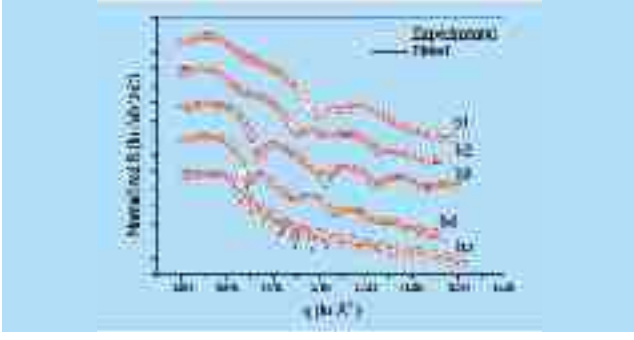

Fig. A.3.2 *GIXRR measurements of bilayers taken at CuKα source.*

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A.4 Design of vacuum ultraviolet polarimeter for Indus-1

Ellipsometric experiments with synchrotron radiation (SR) gives element specific magnetic information about material. To perform these experiments on Indus-1, a VUV polarimeter is designed [*for details please see S. R. Naik, G. S. Lodha, Nuclear Instruments and Methods in Physics Research A, 560 (2006), 211]*. This polarimeter will be installed after the post mirror of toridal grating monochromator based CAT-TGM beamline. To reduce the higher order contamination of SR beam filters will be used. Optical design of polarimeter is completed, which is shown in fig. A.4.1. Polarimeter consists of four-mirror reflector phase retarder and three-mirror reflector linear polarizer.

Polarimetry and ellipsometry require to azimuthally rotate phase retarder and linear polarizer around beam axis. Azimuthal rotation is such that the out going beam position remain unchanged during rotation. In a complete azimuthal rotation phase retarder generates linearly, circularly and elliptically polarized beam, which is shown in fig. A.4.2. In complete azimuthal rotation linear polarizer generates different outgoing intensity pattern, from which the information about the material can be extracted.

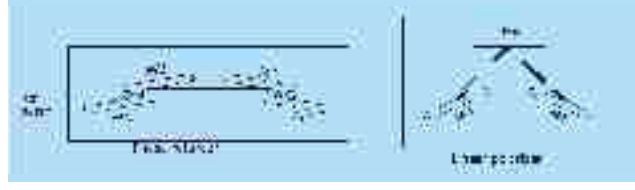

Fig. A.4.1: *Schematic diagram of VUV polarimeter to be installed on CAT-TGM beamline on Indus-1.*

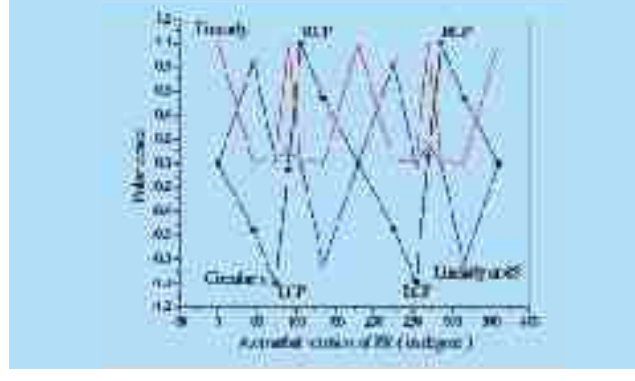

Fig. A.4.2: *Linearly and circularly polarized component of SR beam after PR is drawn as a function of azimuthal rotation of PR.*

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A.5 Analyses of composition at buried interfaces using resonant soft x-ray reflectivity

Normally in x-ray reflectivity (XRR), X-ray photon energy is far away from absorption edges of materials of interest, and the poor contrast in optical constants is not