

## **ARPES Beamline, Indus-1 SRS**

The Angle Resolved Photo Electron Spectroscopy (ARPES) beamline was set up at Indus-1 SRS in 2002. The experimental station of the beamline has been recently upgraded with CCD based electron analyzer system to facilitate PES studies of solid samples in angle integrated mode. In the near future we are going to upgrade the sample manipulator so that beamline can be used for ARPES studies of oriented thin film & single crystal samples also. The monochromator of the angle resolved photoelectron spectroscopy (ARPES) beamline is a 1.4meter toroidal grating type (Jobin Yvon-TGM-1400) covering the wavelength region of 40 to 1080Å with three gratings to cover the entire wavelength region, which is interchangeable without breaking the vacuum. The optics of the ARPES beamline consists of a pre-focusing mirror, the monochromator, and a post-focusing mirror. All the focusing optical elements are toroidal, coated with platinum on zerodur blank. The side view of the optical layout of the beamline is given in figure below. The experimental station of the beamline is capable to record angle dependent photoelectron spectra of solid samples with a facility to prepare the samples in situ. Size of the beam spot at the sample is approximately 1mm x1 mm. Flux at the sample is of the order of  $10^{10}$  photons/sec./mm<sup>2</sup>.

### **Photograph of the Beamline**



## Beamline Parameters

Parameter	Pre-mirror	Post-mirror	TGM
<b>Acceptance (mrad)</b>	8.9(H)x5.2(v)	14.3x8.8	20x12.4
<b>Entrance Arm Length (mm)</b>	3400	1102	1000
<b>Exit Arm Length (mm)</b>	1500	1155	1414
<b>Angle Of Incidence</b>	85.5°	85.5°	162°
<b>Meridional Radius, R (mm)</b>	26732	14380	7977
<b>Sagittal Radius (mm)</b>	165	88.5	182.3
<b>Demagnification Ratio</b>	2.3: 1	0.95: 1	§
<b>Size (mm × mm)</b>	240 × 30	115 × 15	75 × 20
<b>Coating</b>	Pt	Pt	Pt
<b>Gratings</b>	Grating 1 (1800 Grooves/mm) Grating 2 (600 Grooves/mm) Grating 3 (200 Grooves/mm)		

## Experimental Station

The experimental station is capable of both angle integrated as well as Angle resolved PES spectra of solid/thin film samples using a CCD-MCP based electron analyser system (PHOIBOS-150). Presently system is ready for use in angle integrated and angle dependent modes of PES studies. A view of the corresponding experimental station is shown in the figure below. The analysis chamber (mu-metal) is equipped with a sample manipulator, which is useful to position the sample and record the data at any temperature in the range 300 – 1000 K. The ARPES system also has a twin-anode X-ray source for XPS (ESCA) studies, He discharge lamp for high resolution PES, Ar ion sputter gun, LEED-Auger. The overall experimental energy resolution of the beamline is in the range of 140meV-400meV. A load-lock chamber is attached to the analyzer chamber which enables quick transfer of the sample from atmosphere. The sample size, which can be accommodated on the sample holder, is of area 15 mm<sup>2</sup> and 0.5mm thickness. The size of the beam spot is about 1mm X 1mm. The type of the samples that can be taken up for studies on this beamline should be of non-volatile and UHV compatible solids.

## Features

Electron analyzer	<b>PHOIBOS-150 (150 mm mean radius)</b>
Electron detector	MCP based 2d CCD detector, capability for AIPES & Angular mapping PES Measurements
Sample manipulations	400mm (vertical), ±12.5mm(X & Y), two tilts
Vacuum in analysis chamber	< 5x10 <sup>-11</sup> mbar.
Incident flux monitoring	Online normalization of photon flux by sample ground Current/ post mirror ground current

Sample temperature range	300-1000 K
Sample Loading	Quick accessed load lock facility
Sample preparation	Sputtering & annealing facility
Lab sources	He discharge and twin anode X-Ray

**Photograph Showing Experimental Station**

