A.4: Soft and Deep X-Ray Lithography beamline on Indus-2: Commissioning and Test Structure Fabrication

Soft and Deep X-ray lithography (SDXRL) beamline is commissioned and is now under optimisation phase. The beamline is dedicated for X-ray lithography which is widely used technique for fabrication of three-dimensional high aspect ratio microstructures. Figs. A.4.1(a) and A.4.1(b) show the installed view of SDXRL beamline inside optics and intermediate radiation shielding hutches respectively.

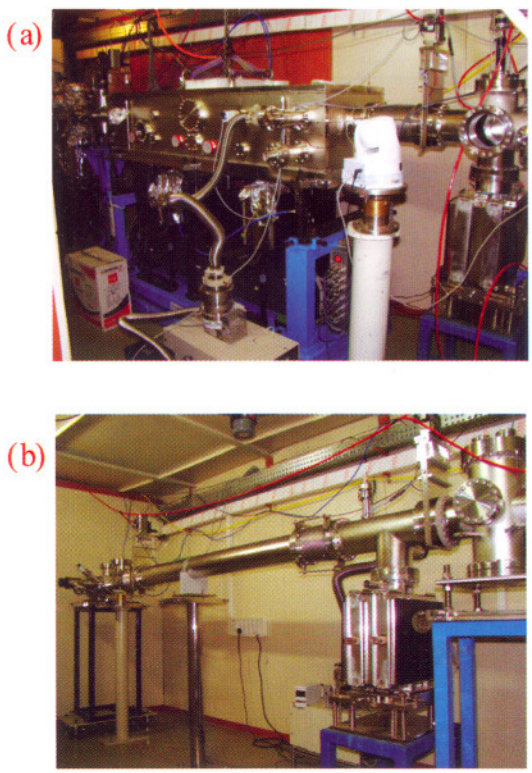

Fig. A.4.1: Installed view of SDXRL beamline inside (a) optics hutch and (b) Intermediate hutch

X-ray scanner (experimental station) on this beamline is commissioned. It consist of mask wafer stage mounted inside vacuum chamber, which can be scanned in vertical direction with scanning speed of 1-30 mm/s, tilted from 0-90^0 and rotated in 0-360^0. Installed view of experimental station inside experimental hutch is shown in Fig. A.4.2, inset shows the mask-wafer stage assembly for mounting the mask and photo resist.

During commissioning trials, the synchrotron radiation (SR) beam is tracked at various positions along the beamline. The profile of the SR beam is measured using wire scanner and X-ray photodiode scanner. Fig. A.4.3 shows the profile of the beam obtained using photo diode scanner at position, downstream to two x-ray mirrors system.

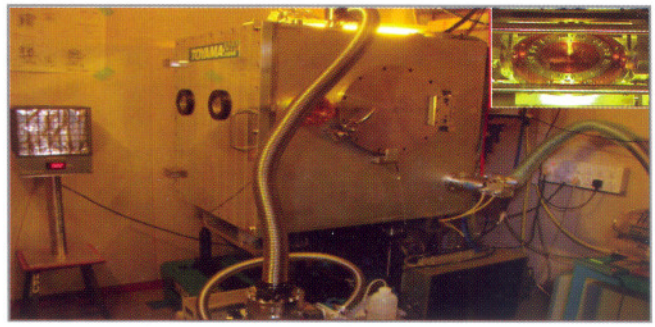

Fig. A.4.2: Installed view of X-ray scanner, inset shows the X-ray mask-wafer stage.

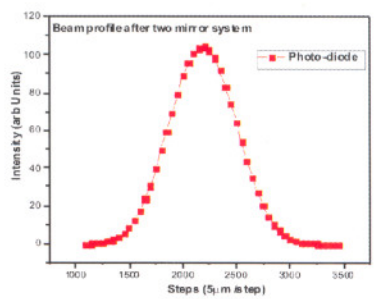

Fig. A.4.3: SR Beam profile obtained using photodiode scanner, downstream to X-ray mirrors system.

Two X-ray mirrors are set to grazing incidence angle (M1(θ1 = 0.2 deg) and M2 (θ2 = 0.2 deg)) to tune beam energy spectrum in the range of 5-12 keV. This spectrum was used to expose X-ray sensitive polymers (PMMA and SU-8). Fig. A.4.4 (a) shows the first microstructure (micro pillars) fabricated on silicon coated with SU-8. Micro pillars are 200 m in diameter, 170 μm deep and 300 μm in pitch. A test micro fluidic device is fabricated on 500 μm thick PMMA sheets (Fig. A.4.4(b)). The width of micro channel is ~ 300 μm.

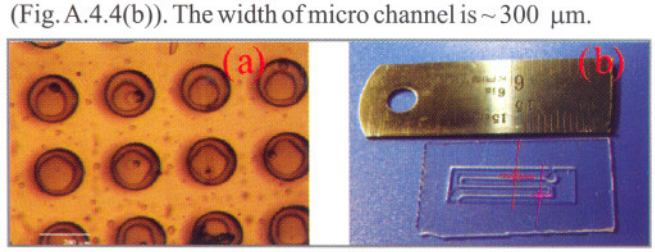

Fig. A.4.4: Test structures fabricated using x-ray lithography beamline, (a) micro pillars (b) micro fluidic device.

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