

A.2: Brief report on Indus beamline utilization

Indus-1 and Indus-2 are national facilities, which have been attracting a large number of researchers from all over the country. The period January to June 2021 saw the second COVID-19 lockdown for about one month followed by startup of Indus machines, which significantly reduced the overall user activity at Indus beamlines. The total number of user experiments carried out at Indus-1 and Indus-2 beamlines in this period was 112. These include a few users from industry for x-ray diffraction measurements.

In March 2021, the Angle resolved photoelectron spectroscopy beamline (ARPES) (BL-10) was opened to users (see Figure A.2.1). This is the first beamline on Indus-2 with an undulator as its source. The beamline is currently available to users with excitation energy from 80 eV to 1000 eV. With this, the total commissioned beamlines in Indus-1 and Indus-2 are 24.

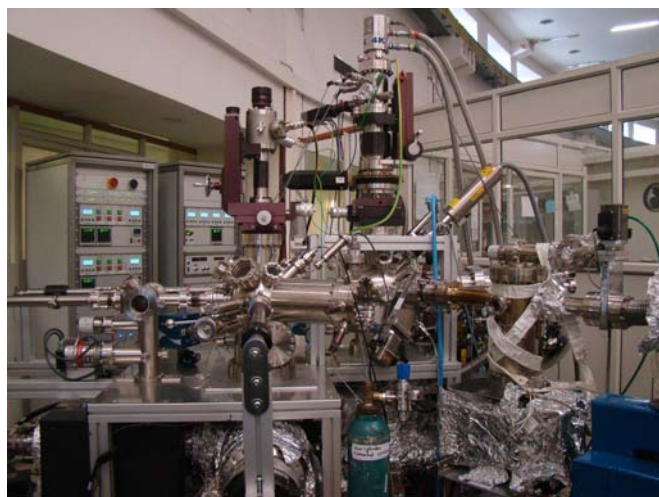


Fig. A.2.1: The view of the experimental station of the BL-10 ARPES beamline.

During this period, about 75 papers were published in peer reviewed international journals. Some of the interesting research results that have been published in this period are summarized below. The structure and thermal stability of carbon doped CoN films, which have applications in high capacity electrode for Li-ion batteries, non-aqueous supercapacitors and solar cells etc have been studied. (Ref: Y. Kumar et al. Appl. Surf. Sci. Vol. 564, p150443 (2021)). The correlation between crystalline structure and enhanced photocatalytic activity in TiO₂ nanorods was reported. (Ref: S. Bhowmick et al. J. Phys. Chem. C Vol. 125, p4846 (2021)). Results on the charge storage mechanism in 2-D tungsten oxide/selenium nanocomposite fabricated for flexible supercapacitors, have been reported. (Ref: R. Barik et al. ACS Appl. Mater. Interfaces Vol. 13, p8102 (2021)). The effect of electronic and crystal structure on the extracellular electron transfer capability of geobacter sulfurreducens for ambient synthesis of stable bifunctional single-atom electrocatalyst for water splitting has been published. (Ref: S. Pedireddy et al. Adv. Funct. Mater. Vol. 31, p2010916 (2021)).

Some important results in the nuclear research sector include the results on the structural investigations on Mo, Cs and Ba ions-loaded iron phosphate glass for nuclear waste storage application, (Ref: D. Dutta et al. J. Alloys Comp. Vol. 850, p156715 (2021)) studies on electron beam irradiation induced changes in local structure of simulated waste bearing sodium borosilicate glasses, (Ref: A. Kumar et al. Nucl. Inst. Methods Phys. Res. B Vol. 486, p85, (2021)) and studies on chemical state of U in modified sodium borosilicate glass. (Ref: N. Praveena et al. Prog. Nucl. Energy Vol. 131, p103579 (2021)).

Several other materials, which have possible technological and device applications have also been studied and results have been reported. Some of them are as follows: Correlation between the structural properties and the electrocatalyst efficiency for ammonia synthesis at room temperature by Cobalt Phthalocyanine nanotubes has been published. (Ref: U. K. Ghorai et al. ACS Nano Vol. 15, p5230 (2021)). The origin of ferroelectricity in the cubic phase of Hf substituted BaTiO₃, and its link with the structural distortion, has been reported. (Ref: A. Sati et al. J. Phys.: Condens. Matter Vol. 33, p165403 (2021)). Electronic and crystal structure of nickel cobalt oxide nanoneedles for applications in electrochromic glucose sensors have been reported (Ref: D.K. Pathak et al. ACS Appl. Nano Mater. Vol. 4, p2143 (2021)). Roles of structure and electron mobilization in enhancing the ethanol sensing capability of Al doped SnO₂ nanoparticles has been published. (Ref: N. Chakraborty et al. Mater. Adv., Vol. 2, p3760 (2021)). The correlation between the structure and half metallicity in Fe₂TiSn_xCr_{1-x} systems and the ability of tuning the half metallic gap with composition has been studied and published. (Ref: S. Chaudhuri et al. Sci. Reps, Vol. 11, p524 (2021)) The studies of the interfacial quality in Cr/Ti multilayers for enhanced reflectivity in the water window region has been reported. (Ref: P Sarkar et al. J. Syn. Rad. (2021). Vol. 28, p224 (2021)) An understanding of defect-mediated cubic to hexagonal topotactic phase evolution in SrMnO₃ thin films and associated magnetic and electronic properties has also been published. (Ref: A. K. Mandal et al. Phys. Rev B Vol. 103, p195110 (2021)).

Some of the interesting applications related to biology and health that have been published, include the following: The structure of yak lactoperoxidase, which is a heme containing oxido-reductase enzyme, and is important as an antibacterial agent, was determined. (Ref: V. Viswanathan et al., Protein J, Vol. 40, p8 (2021)). The structure of first-in-class fragment inhibitors aimed towards the development better tuberculosis curing drugs have been published. (Ref: A. Shukla et al. J. Struct. Bio. Vol. 213, p107655 (2021)). The crystal structure of fungal "proliferating cell nuclear antigen" was determined to shed a light on the role of its complex structural elements on the inter-species functional compatibility. (Ref: Premlata Kumari et al. J. Biol. Chem. Vol.297, p100911(2021)).

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