



A.1: Utilization of Indus beamlines

Indus-1 (450 MeV, 100 mA) and Indus-2 (2.5 GeV, 200 mA) are India's only two synchrotron radiation sources. Both have been operating in round the clock mode for several years now. Six beamlines on Indus-1 and thirteen beamlines on Indus-2 are currently operational. These are being extensively used for a variety of frontline experiments by researchers from academic institutions, national laboratories, and universities. Investigations are being carried out in diverse areas of basic and applied research such as x-ray diffraction and x-ray absorption etc for applications to materials science, x-ray imaging, spectroscopy, protein crystallography, micro-fabrication etc.

Since last few years, there has been an extensive increase in the utilization of the beamlines with an increasing number of user experiments that are being carried out at the Indus-1 and Indus-2 beamlines. Figure A.1.1 gives a graphical representation of the number of users experiments that have been carried out at the Indus beamlines since 2011.

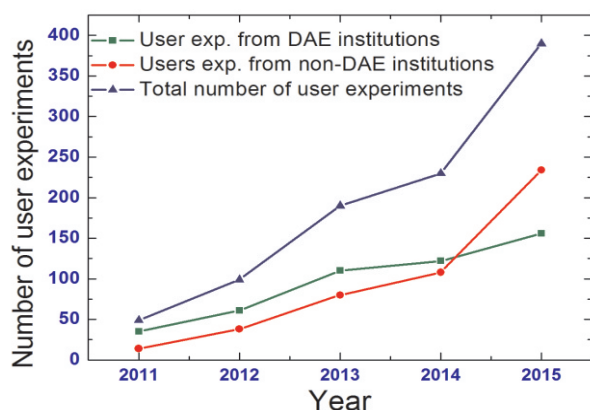


Fig. A.1.1: Graph showing the number of user experiments carried out in different years.

One can clearly see the increasing number of experiments that are being carried out at the Indus beamlines with every passing year. In the calendar year 2015, the total number of user experiments at Indus beamlines was 390. The large number of user experiments is also reflected in a large number of publications in international peer reviewed journals and international conferences. There have been about 100 publications in international journals in the year 2015. A brief summary of some of the important works carried out by beamline users this year are given below:

The correlation of Mo dopant with the photo-catalytic properties of Mo incorporated in TiO_2 have been determined using EXAFS measurements by BARC scientists [Ref: Jerina Majeed et al. Royal Soc. Chem. Adv. 5, 90932 (2015)]

EXAFS studies to understand the role of local structure in nitrogen doped TiO_2 thin films for applications in

photocatalysis, solar cells, gas sensors, antimicrobial coating etc. have been carried out by IGCAR scientists. [Ref: Madhusmita Sahoo et al. J. Phys. Chem. C 119, 17640, (2015)]

Scientists from IISc, Bengaluru have studied the structural properties of protein in Mycobacterium tuberculosis uracil-DNA glycosylase and its functional implications using the protein structure determined at the Protein crystallography beamline. [Ref: S. M. Arif et al. Acta Cryst. D71, 1514, (2015)]

TIFR, Mumbai and BARC researchers have jointly studied the structural phase transitions in trigonal selenium with pressure and the formation of a disordered phase at high pressure using XRD measurements at high pressure using the ECXRD beamline. [Ref: Anirban Pal et al. J. Phys. Cond. Matt. 27, 415404 (2015)]

An insight into the origin of ferromagnetism in Fe-doped ZnO dilute magnetic semiconductor nanocrystals and the role of local structure has been analysed by IIT BHU scientists using EXAFS analysis. [Ref: Shiv Kumar et al. Royal Soc. Chem. Adv. 5, 94658 (2015)]

Band alignment and photon extraction studies in Na-doped MgZnO / Ga-doped ZnO heterojunction for light-emitter applications have been studied using the Angle Integrated Photoelectron Spectroscopy beamline by scientists from IIT Indore. [Ref: Sushil Kumar Pandey et al. J. Appl. Phys. 118, 165301, (2015)]

Physiochemical investigation of shape-designed MnO_2 nanostructures and their influence on oxygen reduction reaction activity in alkaline solution have been analyzed using EXAFS by scientists from Central Electrochemical Research Laboratory, CECRI, Karaikudi [Ref: K.Selvakumar et al. J. Phys. Chem. C 119, 6604 (2015)]

The room temperature magneto-dielectric property and its correlation with the structure of Mn doped LaGaO_3 have been analyzed by IIT Indore scientists using the Angle dispersive XRD beamline. [Ref: H.S. Late et al. Mat. Res. Exp. 2, 09105, (2015)]

Magnetic and optical properties of Fe doped CuMnO_2 and their correlation with the structural properties has been made using XRD measurements jointly by IIT(BHU) and TIFR scientists [Ref: K.K.Shukla et al. Royal Soc. Chem. Adv. 5, 83504, (2015)]

X-ray lithography beamline has been used for the development of several microstructures. Compound refractive lenses have been made for microfocussing of X-rays down to a few microns and have been used at Indus-2 beamline and at Diamond Light Source, UK.

Reported by:

T. Ganguli and P.A. Naik (panaik@rrcat.gov.in)