A.2: Utilization activities of Indus beamlines

Indus-1 and Indus-2 are national facilities which have been attracting a large number of researchers from all over the country. Two new beamlines: "Beamline for engineering applications" (Figure A.2.1) and "Small and wide angle x-ray scattering beamline" were commissioned in March 2019, thus taking the total number of operational user beamlines in Indus-1 and Indus-2 to 20. In the period January 2019 to June 2019, the total number of user experiments that were carried out at the Indus-1 and Indus-2 beamlines were 512. These include a few users from the industry who have used the EXAFS and XRD beamlines.

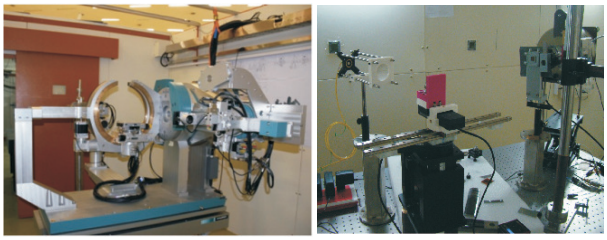

Fig. A.2.1: A view of the angle dispersive experimental station (left) and the energy dispersive experimental station (right) at the beamline for engineering applications, Indus-2.

Some of the upgrades that have been implemented in the existing beamlines include: hard x-ray XMCD measurement setup at dispersive EXAFS beamline, development of a simultaneous XANES and XRD measurement facility at low temperature at ADXRD beamline and installation of a glove box to handle radioactive materials at the EXAFS beamline. During this period, about 100 papers were published in peer reviewed international journals. The topics covered in these publications cover a diverse range of disciplines, namely: materials science, biology, chemistry, nanoparticles, industrial applications, etc. Some of the interesting research results that have been published in the last six months are summarized below.

Different groups have worked on various aspects of materials for batteries that have the potential for applications in the next generation earth abundant sodium-based batteries. These include studies on nanostructured vanadium tri-oxides, as a long life and high-performance anode for sodium-ion battery, (Ref.: Ananta Sarkar et al. Electrochimica Acta 299 (2019) 914), and electrical transport in NaI nanocomposites based superionic conductors (Ref.: M. Dinachandra Singh et al. Mat. Res. Bull. 118 (2019) 110485). Work on other novel energy storage materials like 3D mesoporous flowers of nickel carbonate hydroxide hydrate, (Ref.: Prateek Bhojane et al., Electrochimica Acta 296 (2019) 112), mesoporous 3D network of Ce-doped NiO nanoflakes as high-performance electrodes for supercapacitor applications, (Ref.: P. E. Saranya et al. New J. of Chem., Issue 19, 2019), and substituted $Na_{0.5}Bi_{0.5}TiO_3$ ceramics, (Ref: Anita Verma et al. J. Alloys and Compounds 792 (2019) 95) have also been carried out. Studies on new materials for catalysis like zinc oxide nanosheet for high-performance photocatalysis of water pollutants (Ref.: Abesh Banerjee et al. Ceramics Int. l, 45 (2019) 16821), and studies on mesoporous Ni/NiO catalyst for conversion of oxygenates to fuels and chemicals (Ref. Hari Singh et al. Mat. Res. Bull. 112 (2019) 363) have also been reported in this period. Imaging of porous structures and their correlation with the physical properties, like establishing the correlation among pore structure, surface roughness, compressive strength, and fracture toughness of ceramic water filters manufactured locally in Rajasthan, (Ref: Amrita K. Nighojkar et al. Desalination and Water Treatment, 157 (2019) 332), microtomography of polymer derived macroporous SiOC ceramics for applications in porous burners, catalyst supports, filtration media etc. (Ref: Abhisek Choudhary et al. Adv. Engg. Mat., 21, (2019) 1900172), and the estimation of porosity and pore distribution in hydrated portland cement at elevated temperatures (Ref: Harsha Pavani et al. J. of Adv. Concrete Tech., 17 (2019) 34) have been published. In the context of metals and intermetallic alloy and their related studies, the microstructure of proton irradiated T91 alloys have been carried out (Ref.: Argha Dutta et al. J. Nuclear Materials 514 (2019) 161) and the 3D spatial distribution of mineral phases in ores using high resolution synchrotron micro-computed tomography (μCT) have been reported. (Ref.: A. Fatima et al. Appl. Rad. Isotopes 148 (2019) 49). The first paper on XMCD measurements carried out at BL-01 on understanding the anomalous magnetic properties of Fe_3O_4 nanostructures on GaAs substrate was published in this period. (Ref.: D.M. Phase et al. J. Magnetism and Magnetic Materials 482 (2019) 296). Work on light emitting spin active electronic states in ultra-thin Mn doped CdSe layered nanosheets for futuristic device applications have also been reported (Ref: O. Haldar Sci. Reps. 9 (2019) 1804). In the sphere of applications to biological and medical sciences, the work on a multivariate analysis of trace elemental data obtained from blood serum of breast cancer patients and its correlation with the occurrence of the disease was carried out. (Ref.: B. Gowri Naidu et al. Results in Physics 12 (2019) 673). The structure of Pyrrolidone-carboxylate peptidase-1, enzyme that recognizes and processes the pyroglutamate containing hormones for their regulation was determined. (Ref.: R. Agrawal et al. Acta Crystallogr D Struct Biol. 75 (2019) 308). A new type of enzyme (carboxypeptidase) in the prolyl oligopeptidase enzyme family, which has therapeutic importance in diseases such as diabetes, cancer, neurological diseases and autoimmune disorders was identified and its structure determined. (Ref.: P. Yadav et al. J Biol Chem. 294 (2019) 89).

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