

A.2 Activities at Indus beamlines

Beamlines at Indus-1 and Indus-2 are national facilities that have a total of 18 operational beamlines. These beamlines have been in regular use by the scientists, researchers and students from the Indian academia and Indian industry. The total number of user experiments that have been carried out at Indus beamlines in the period of January 2023 to June 2023 were 524.

During this period, the total number of papers published in peer reviewed international journals exceeded 90. Work on diverse topics based on the experiments that have been carried out at the Indus beamlines, which include: materials science, biology, chemistry, physics, etc., have been published. Some of the published works are highlighted below:

Different groups have worked on several problems related to energy materials. The understanding of structural changes in $\text{LiNi}_x\text{Mn}_y\text{Co}_z\text{O}_2$ cathodes of Li ion batteries during charging and discharging has been reported (Ref.: N. Abharana et al., *Solid State Ionics*, Vol. 398, p 116270 (2023)). Results related to the development of a high-rate-capable O3-structured 'layered' Na transition metal oxide by tuning the cation–oxygen bond covalency for electrodes in Na ion batteries has been published (Ref.: Ishita Biswas et al., *Chem. Commun.*, Vol. 59, p 4332 (2023)). By carrying out in-operando synchrotron X-ray diffraction and stress measurements, the process of degradation of the metal electrodes of Li ion batteries has been analysed and published (Ref.: Ankur Sharma et al., *ACS Appl. Mater. Inter.*, Vol. 15, p 782 (2023)). In a related work on characterization of carbon containing shale rocks, the pore anisotropy in shale, its dependence on thermal maturity and its organic carbon content was studied and published (Ref.: J. Bahadur et al., *Int. J. Coal Geo.*, Vol. 273, p 104268 (2023)).

Several interesting materials science problems aimed at development of devices in the future, have been studied and published. These include the following: Enhanced temperature coefficient of resistance in nanostructured $\text{Nd}_{0.6}\text{Sr}_{0.4}\text{MnO}_3$ thin films for spintronic applications has been reported (Ref.: Mrinaleni R. S. et al., *Thin Solid Films*, Vol. 779, p 139933 (2023)). Magneto-strain effects in 2D ferromagnetic van der Waal material CrGeTe_3 for spintronic device applications has been published (Ref.: Kritika Vijay et al., *Sci. Rep.*, Vol. 13, p 8579 (2023)). Piezoelectric properties and structural evolution in La- and Al- modified $\text{K}_{0.5}\text{Bi}_{0.5}\text{TiO}_3$ ceramics for lead free ferroelectric applications has been reported (Ref.: Manish Badole et al., *J. of Alloys & Comp.*, Vol. 944, p 169204 (2023)). Tunable magnetoresistance driven by electronic structure in Kagome semimetal $\text{Co}_{1-x}\text{Fe}_x\text{Sn}$ was published (Ref.: Kritika Vijay et al., *Appl. Phys. Lett.*, Vol. 122, p 233103 (2023)). Ultrafast carrier relaxation and second harmonic generation in higher-fold Weyl Fermionic system PtAl for high-speed device applications has been reported (Ref.: Vikas Saini et al., *Adv. Phys. Res.*, Art. No. 2300063 (1 of 8) (2023)). Enhanced magneto-dielectric properties of Pr-doped polycrystalline $\text{Gd}_{0.55}\text{Pr}_{0.45}\text{MnO}_3$ at low temperatures for applications as multiferroics has been reported (Ref.: Pooja Pant et al., *J. Mag.*

Magnetic Mat., Vol. 572, p 170621 (2023)). Chemical inhomogeneity and amorphous to crystalline transformation in CoFeB/MgO based magnetic tunnel junctions has been reported (Ref.: Pramod Vishwakarma et al., *Mat. Res. Bull.*, Vol. 161, p 112150 (2023)).

In the area of basic materials science, some of the work published include: the structural evolution in GdVO_4 under extreme pressure (Ref.: Ankit Bhoriya et al., *J. Solid State Chem.*, Vol. 324, p 124072 (2023)), and crystallographic structural variations in nano-crystalline Sc_2O_3 under pressure (Ref.: D. Yadav et al., *Phys. Scr.*, Vol. 98, p 045707 (2023)).

Regarding applications in the nuclear industry, the following works are reported. A novel gamma ray shielding block developed using alumina industry waste has been reported (Ref.: Rahul Arya et al., *Const. & Building Mat.*, Vol. 373, p 130895 (2023)). Studies of defects generated in neutron-irradiated austenitic stainless steels at low displacement damage levels has been published (Ref.: Shreevalli M. et al., *J. of Nucl. Mat.*, Vol. 577, p 154338 (2023)). Understanding the process of microstructure and defect evolution in oxygen ion-irradiated pure nickel, for applications in high temperature and other extreme environment is reported (Ref.: U. Saha et al., *Mat. Chem. & Phys.*, Vol. 305, p 127916 (2023)).

Several results on biological problems that have been carried out and published have been summarized below, A detailed insight into the inhibitory mechanism of new Ebselen derivatives against main protease (Mpro) of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) has been reported (Ref.: P Sahoo et al., *ACS Pharmacol. Transl. Sci.*, Vol. 6, p 171 (2023)). New insights into the antimalarial mechanism of Chloroquine, the most common malarial drug, has been published (Ref.: Rahul Singh et al., *ACS Infect. Dis.*, Vol. 9, p 1647 (2023)).

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