

**Report on International Collaborative Research at  
Pohang Accelerator Laboratory, South Korea, during 14-20  
December, 2019.**

**Department of Physics,  
Manav Rachna Univeristy, Faridabad**

Name of the Principal Investigator: **Dr Aditya Sharma**

Name of M.Sc, Students, who performed the experiments,: **Ms. Surekha Chaudhary  
and Himani Saraswat**

Duration of Experiments:

14<sup>th</sup> -20th December 2019,

**Brief Profile of the Principal Investigator:**

Dr. Aditya Sharma is an assistant professor in department of Physics, MRU, Faridabad. He is a dynamic and versatile persona and is an IUAC, New Delhi alumni with 10 years of experience in Nano-hybrid materials research based on ions & synchrotron accelerators. He was a visiting research scientist at Korea Institute of Science and Technology, Seoul, South Korea and has published more than 40 research papers in SCI/SCOPUS journals, several book chapters and also functioning as an editor/reviewer of various international journals.

**The objective of the International research collaboration:**

To enrich the students of Manav Rachna Univeristy, with the concept & design of modern accelerator machines, their utilization in the Nano-hybrid materials for probing their functionality in the futuristic applications; such as, Gas-sensors, Solar-cells, Batteries, photo-catalyst and bio-medical.

The collaborative research efforts were aimed to give hand-on training to the research students, developing the new material using the sophisticated techniques (which are less-accessible in our country) for the futuristic technology, and to fill the gap between academia and research centres/laboratories of high standard.

**Outcomes:**

The outcomes of the research experiments at Pohang Accelerator Laboratory, South Korea, are directly matching with the objectives as the P.I of the research proposal and the scientist of the inviting laboratory are able to justify the experimental results with the expectations made before the experiments. Several research papers in SCI/SCOPUS journals will be communicated after analysis/simulation of the experimental data. Moreover, the students get trained to operate the machines, using the vacuum techniques and production/focusing of the X-rays. This will help to the students for their future research career.

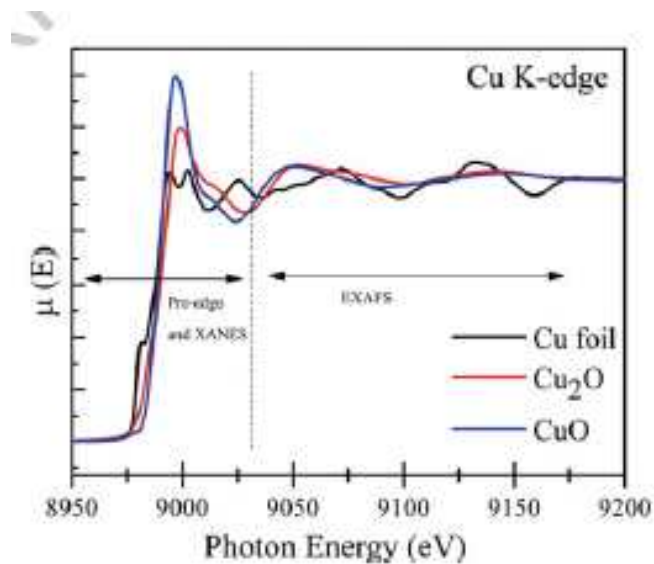
**About the Experiments using the X-ray absorption spectroscopy beam line of Pohang Accelerator Laboratory, South Korea.**

The experiments were started by loading the previously prepared samples in high vacuum chamber. The thin films of SnO<sub>2</sub>, SrVO<sub>3</sub>, InGaZnO, ZnSnO<sub>3</sub> were deposited

using the RF-magnetron sputtering technique on Si and Quartz substrates using the experimental facilities of IUAC, New Delhi. Some of the thin films were also ion-implanted (to modify their Fermi-level and adjust their orbital hybridization) with 200 keV Cu ion beams. A few of the Nano-hybrid materials ( $\text{CeHfO}_2$ ,  $\text{HfSmO}_2$ ,  $\text{HfEuO}_2$ , AgCu-Graphene-oxide,  $\text{Cu}_2\text{O}$ , etc) were prepared in the Laboratory of Physics Department, Manav Rchna Univeristy.

Such samples were subjected to the X-ray interaction to probe the local electronic structure, hybridization of frontier orbitals and evaluate the local structural disorders caused by the ion-implantation

Variation in the absorption coefficient from the samples was measured as a function of photon energy. Difference in the hybridization of orbital was observed as a function of Cu ion implantation which supports our hypothesis of ion-implantation and doping induced modification in the electronic properties of materials. An example of XAS data is provided which was collected from the Cu K-edge of a few samples.



The experiments were finalized with a warm vote of thanks to the Korean Scientist (Dr. Hyun-Joon Shin, Director of R&D division, PAL, South Korea) who invited us (Dr. Aditya Sharma and M.Sc. students of Manav Rachna University), and helped to conduct the experiments.

A few glimpses of the session are attached herewith.

