



From the Director's Desk...

I am happy to present to you the first issue of RRCAT Newsletter for the year 2023. This issue highlights various R&D and infrastructural accomplishments of the Centre from July - December 2022.

During this period, Indus-1 and Indus-2 were operated in round-the-clock mode for 168 days, and more than 500 users conducted experiments in the beamlines. It is heartening to inform the readers that during the calendar year 2022, Indus-2 was operated for a total of 339 days, and 991 user experiments were conducted using these two machines, which is the highest in a calendar year so far. During this period, the undulator-based beamline for X-ray magnetic circular dichroism became operational after approval from AERB. Under the training qualification and licensing programme, a new batch consisting of more than 40 personnel was trained for round-the-clock operation of the Indus facility. The user experiments have yielded more than 100 papers in international peer-reviewed journals covering a wide range of topics in physics, chemistry, and materials science.

Some of the important works associated with the Indus-2 facility reported in this edition include development of a high-current and low-voltage (1000 A/10 V) magnet power supply for testing the superconducting magnets, design and simulation of superconducting wavelength shifter vacuum chamber to be installed for generating hard x-rays, and the development of a SCADA-based control system to remotely control and regulate the heat cycles of the vacuum furnace for joining aluminum alloys making bimetallic joints.

In the previous edition, it was informed that the electron beam radiation processing facility is all set to provide e-beam irradiation services to medical devices and other industrial products on a commercial basis. A significant achievement in this direction is the utilization of the e-beam irradiation facility for sterilization of around one million units of intravenous cannula as per the regulatory requirements under the MoU signed with M/s Becton Dickinson. The reports devoted to the work on the reflectivity studies of Sc/Mg multilayer systems and the estimation of the impedance of vacuum components in accelerators using theoretical simulations are also included in this edition.

The second part of the newsletter highlights some of the achievements in the area of laser technology and application of lasers. To support the Centre's programme on the high energy Nd:Glass laser, a two-beam pre-amplifier system capable of generating laser pulses of 3 ns duration and energy more than 4 Joule per arm has been developed. The achievements related to the application of lasers in the material processing like laser directed energy deposition based additive manufacturing of copper-stainless steel functionally graded material and the improvement in ratcheting fatigue life of high strength low alloy steel by laser shock peening are highlighted. Some of the other activities from the allied areas of laser science and technology included in this edition of newsletter are: fabrication of turn around point long period fiber grating by thermal relaxation of UV induced refractive index for greater thermal stability, development of an ultra-narrow band UV metal-semiconductor-metal detector based on p-GaN with epilayer of unintentionally doped GaN, synthesis of cesium lead halide based perovskites with tunable high photoluminescence characteristics, and experimental study on the role of $J \times B$ force on the acceleration of electrons due to interaction of ultrashort highly intense laser with metal foil to demonstrate the dominance of this force in the generation of fast electrons.

A section on *Theme Articles* has been a regular feature of RRCAT newsletter. This edition contains three *Theme Articles* providing detailed reviews of some of the selected R&D activities carried at the Centre over a long period of time. The first two articles review the development of two potential accelerator-based facilities, i.e., the development of hydrogen ion sources for proton accelerators, and an infra-red free electron laser (IR-FEL) facility for IR-THz spectroscopy of materials. The third *Theme Article* based on research work carried out as a part of Ph. D. thesis describes the development of GaN photodetectors for detection of ultra-violet radiation.

The section on *Events and Happenings* covers several important activities and functions organized at RRCAT. I am happy to note that the Incubation Centre-RRCAT has undertaken several activities, which include organization of one-day interaction meeting on "Fostering RRCAT- Industry Partnership with Technology Transfer & Incubation", a certificate course on "Additive Manufacturing: Principle, Technologies & Applications", was conducted in collaboration with IIT Indore, incubation agreement for establishing a 10 kW, 10 MeV electron linear accelerator (KIRTI-1010), etc. Under public outreach program, various functions were organized, which include the inauguration of "Light Exploratorium" in Sukhniwas Palace by Dr. Anil Kakodkar on 8th July, 2022, celebration of the DAE iconic week (August 22-28, 2022) under Azadi ka Amrit Mahotsav and a commemorative event jointly organized with Vigyan Bharati on 4th Nov., 2022, remembering the contribution of Dr. Homi Jehangir Bhabha in nation building. I take this opportunity to congratulate all the scholars, who have been awarded Ph. D. degrees by HBNI and all the staff members who have won accolades for their respective contributions in R&D work.

I appreciate the efforts put in by the Editorial Board to bring out this issue of the Newsletter, showcasing the accomplishments of the Centre.

With best wishes,
July 21, 2023

S. V. Nakhe
Director, RRCAT