



From the Director's Desk...

I am delighted to see the publication of the second issue of RRCAT Newsletter for the year 2023 highlighting various R&D and infrastructural accomplishments of the Centre from January - June 2023.

In this period, the two synchrotron radiation facilities Indus-1 and Indus-2 were operated smoothly in round-the-clock mode for 165 days excluding the two planned shutdown sessions for performing various experiments and undertaking preventive maintenance jobs. A total of 524 user experiments have been carried out at Indus beamlines during the period of January - June 2023. During this period more than 90 papers based on the experiments carried at Indus beamlines have been published in international peer-reviewed journals covering a wide range of topics in physics, chemistry, and materials science.

The electron beam radiation processing facility of RRCAT is used for sterilization of several batches of intravenous cannula, and other medical devices have been irradiated as per the guidelines. These products otherwise would have been sent outside India for e- beam processing. The work associated with Indus facilities highlights development of power converter for combined function corrector magnet to carry out closed orbit distortion corrections, upgradation of the vacuum system of Transport Line-2 connecting Booster to Indus-1 storage ring and low-conductivity water cooling system for Indus-2 with ± 0.5 °C temperature stability. Other activities related to the development of accelerator technology includes the processing of high- β nitrogen-doped single-cell superconducting RF cavity at 650 MHz with extremely low field emission, setting up of a soft x-ray fluorescence-based x-ray spectrometer at the x-ray reflectivity beamline, BL-03 of Indus-2, design and development of a four-layer VME delay generator based on field programmable gate array board producing multiple delayed trigger outputs with low timing jitter, which will be beneficial for future accelerators, and UHV compatible electrical feedthroughs.

The achievements in the areas of laser technology, laser based spectroscopy, and allied fields of laser science are highlighted in the second section. Towards development of various lasers, an AO Q-switched Yb-doped fiber laser producing 3.3 mJ pulse energy and 100 W average power for potential cleaning and decontamination application and a fiber based ultrafast Mamyshev oscillator, which can circumvent the limitations of pulse energy of conventional all normal dispersion configuration oscillators have been developed. Development of laser based cold atom gravimeter providing an accuracy in the measurement of g up to fifth digit has also been done. Gallium nitride and its alloys with Aluminium and Indium are important due to their numerous applications in light emitters and detectors. A Nitride MBE facility has been set up at RRCAT, which can be used to grow high crystalline quality layers of nitride materials e.g., GaN, AlGaN, InGaN, InAlN. Realizing the importance of two-dimensional materials in optoelectronics and quantum technology, a microscopic mechanical exfoliation setup has been built at RRCAT to prepare two-dimensional semiconductors. Besides, the developmental works, laser application in basic science involving measurement of charge density wave in quasi-two-dimensional metallic samples of EuTe_4 using time-resolved x-ray diffraction technique has also been performed.

The section on *Theme Articles* constitutes an important part of the RRCAT newsletter. In this edition, we have presented three *Theme Articles* providing detailed reviews of some of the selected R&D activities carried out at the Centre over a long period of time. First theme article reviews the progress made in the material joining technologies and the second one is devoted to the development of optical thin-film coating and characterization facilities at RRCAT. The third *Theme Article* is based on a Ph. D. thesis devoted to the study of acceleration and transport of energetic electrons generated by high-power, ultra-short, intense laser pulses in dense plasma.

During this period several events and functions have been organized at RRCAT, which has been presented in the section on *Events and Happenings*. 40th Foundation Day function of RRCAT was celebrated on 20th February 2023 with Shri K. N. Vyas, Chairman, Atomic Energy Commission and Secretary, Department of Atomic Energy as the Chief Guest. On this occasion, RRCAT also signed four incubation and one technology transfer agreements with industries and startups. To commemorate, the discovery of Raman Effect, National Science Day was celebrated at RRCAT on 25th and 26th February 2023 with a theme on "Global Science for Global Wellbeing". On this occasion, visits were organized for the school and college students, teachers, family members and guests of RRCAT staff and invitees from public. This section also contains other reports on organization of workshop, theme meeting, activities devoted to the radiation and fire safety, clean and green campus, RRCAT Staff Club, accomplishments of AECS, Indore and Women's Welfare Committee.

I congratulate all the scholars, who have been awarded Ph. D. degrees by HBNI and all the staff members who have won accolades for their contributions in R&D work. We have also included a list of new members who have joined RRCAT and welcome them to the RRCAT family and we remember all those colleagues, who have superannuated from their services during this period and we wish them a happy and healthy post retirement life.

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

With best wishes,
May 3, 2024

S. V. Nakhe
Director, RRCAT