



From the Director's Desk...

It is my privilege to bring to you this issue of RRCAT Newsletter, highlighting the progress made by the Centre during January – June 2021. The vibrant activities of the Centre were brought to standstill for a few weeks during April – May 2021 due to the nationwide lockdown, to prevent the spread of COVID-19. Activities were brought back to pace, starting from the first week of June 2021, following the COVID-19 protection guidelines. Substantial progress has been made by the Centre during this period, with continued emphasis on advanced technology, scientific research, education, outreach, technology transfer and technology incubation. The editorial team has worked meticulously to present to you fair glimpses of the progress on all these fronts.

The national indigenous synchrotron radiation facilities Indus-1 and Indus-2 continued to be operated in round the clock mode for 123 days during this period. New optimization of user orbit was performed in Indus-2, and a notable enhancement in its beam lifetime to 104 hours was observed, as measured at 100 mA @ 2.5 GeV. In Indus-2, the first commissioned beamline with insertion device, namely the Angle Resolved Photoelectron Spectroscopy (ARPES) beamline (BL-10) has now been made available to the users, and user experiments have been performed using this beamline. During the recent years, technology has been established in-house for removal of carbon that commonly gets deposited on mirrors used in synchrotron beamlines over a period of its usage, which is described in a *Theme Article*. Using Indus accelerators, 112 user experiments have been performed, including the few ones carried out on x-ray diffraction beamline, by users from the industry. Novel experimental studies have been carried out in several areas of research, such as materials for technology and device applications, biology, health, nuclear technology, etc. Based on the user experiments, 75 research papers were published in peer reviewed journals during the period of this issue of RRCAT Newsletter. One of these publications is on the structure of first-in-class fragment inhibitors aimed towards the development of better tuberculosis curing drugs.

On the front of development of industrial electron linac, namely Linac-3, notable progress has been made by successful demonstration of its first non-stop operation for 8 hours at 9.5 kW. For the earlier developed two 10 MeV, 6 kW electron linacs (Linac-1 and Linac-2), licenses have been obtained from AERB, FDA and CDSCO for its operation for medical sterilization. Using these linacs, successful bulk sterilization of a truck load of self-standing Viral Transport Media (VTM) tubes for Covid-19 samples, and petri-dish has been accomplished. An important milestone has been achieved for the ongoing project on development of an infra-red free-electron laser (IRFEL) with the demonstration of its first saturation of lasing at a cw average power of 19 mW at 23 μm . Towards the efforts to develop the advanced technology of 1 GeV H⁻ injector linac, remarkable progress has been made over last few years by setting up of state-of-art infrastructure and technologies for all stages of development of superconducting cavities, which are described in a comprehensive manner in a *Theme Article*.

Commendable progress has been made towards laser applications. A non-contact shadowgraph technique based machine vision metrology system has been developed for rapid and automated inspection of end plates of PHWR fuel bundle, which is deployed at NFC, Hyderabad. A CO₂ laser based automated system has been developed for BRIT, Mumbai, for the fabrication of tritium-filled self-illuminated glass tubes. As a part of capacity building for interferometric gravitational wave detection, an ultra-narrow linewidth non planar ring oscillator laser systems has been developed, and linewidth of less than 75 Hz over 38 ms integration time has been demonstrated. A 1600 nm, 50 W cw Er-doped fiber laser has been successfully developed for various applications. On the front of development of different optical components such as laser rods/slabs, mirrors etc., and their characterization, particularly for building high energy lasers, notable progress has taken place during the last few years, by setting up of infrastructural facilities, which is nicely described in a *Theme Article*.

Appreciable progress has taken place on the front of materials research too. A γ -ray detector based on CsI(Tl) scintillator coupled with GaAs PIN detector has been successfully developed and characterized. Interesting and useful studies have been performed to establish laser shock peening as post processing tool, to enhance the mechanical strength of LAM built maraging steel. Multi-layered nanolaminates (NLs) of Al₂O₃/TiO₂/Al₂O₃ (ATA) of dielectric constant as high as 670 have been developed, which can be used for metal-insulator-metal (MIM) capacitors and are promising candidates for next generation energy and data storage applications.

Scientific activities carried out at the Centre have resulted in 104 publications in peer reviewed journals, and several publications in conference proceedings, during this period. Incubation Centre at RRCAT has made good progress, and an incubation agreement has been signed between RRCAT and Tata Motors Limited to jointly develop next generation refrigeration technology for vehicles and cold chain transports in the category of chilled, frozen and cryogenic temperature range. Technology transfer of high-stability, unipolar and bipolar power converters for electromagnets has also taken place.

My hearty congratulations to the winners of various individual and group achievement awards for the year 2019 under the DAE-ESETA scheme. I also congratulate those who have been awarded Ph. D. degree by HBNI, and won Best Thesis / Best Poster Awards.

I sincerely express my appreciation to Chairman, Convener and members of the Editorial Board in showcasing a wide spectrum of activities of our Centre and bringing out this issue of Newsletter in time.

With best wishes,

December 6, 2021

S. V. Nakhe
Director