ANNUAL REPORT
2018-19

CENTRE FOR NANO AND SOFT MATTER SCIENCES

Autonomous Institute under the Dept. of Science and Technology, Govt. of India

...in pursuit of Global excellence
in Science and to nurture
Indigenous Technology for the
betterment of Our Country.

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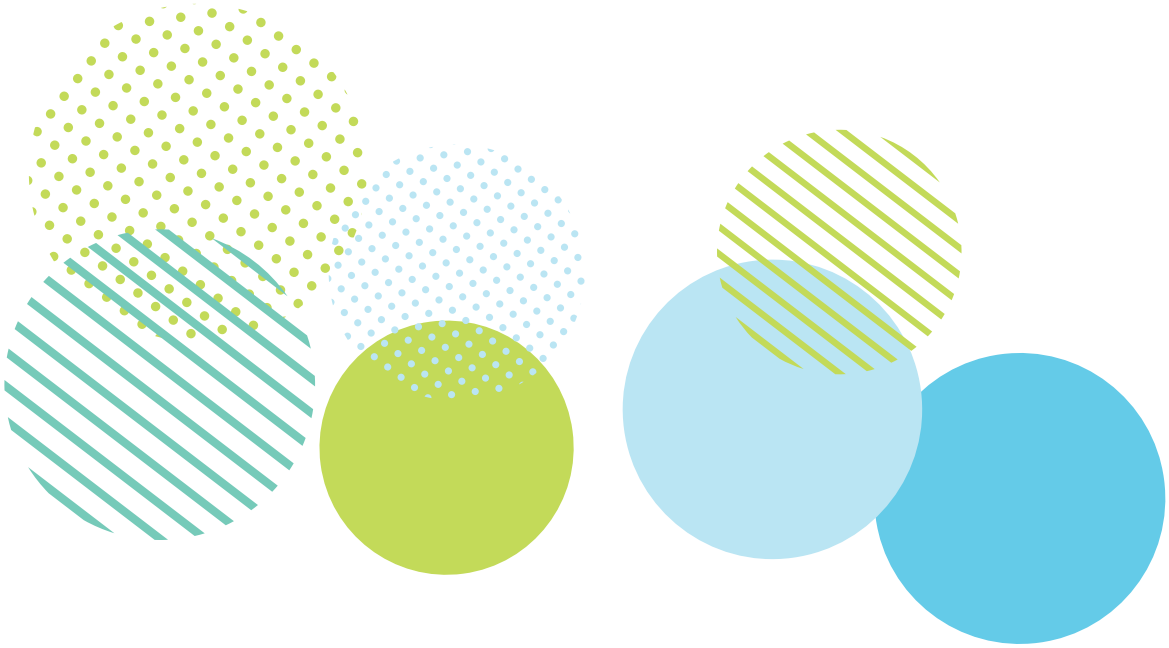
CeNS



ANNUAL REPORT 2018-19

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FOREWORD

Centre for Nano and Soft Matter Sciences (CeNS) with its present mandate has entered into the sixth year. The in-house inventions are steadily progressing towards realizing affordable futuristic technologies. Nanotechnology being the focus, the diversity in research borne out of interdisciplinary is but natural; Nano connects and percolates seamlessly into the diverse areas of science and technology. CeNS exercises an open-minded approach to R&D in Nanotechnology with high emphasis on IP generation and technology realization. The Centre has embarked on collaborative activity with well-known industries. A Technology Business Incubator is being launched as a project funded by DST Nano Mission.

Outreach programmes of the Centre launched three years ago, (V4) for the popularization of science among school children, and Research Outreach Initiative (ROI), an internship programme for the benefit of students in their post-graduate degree in science or in engineering, are being continued with all vigour. A new programme, TechBuddy, meant to provide momentum to translational activities has gathered momentum. A number of students are being enrolled for research programmes leading to PhD, in the area of nanoscience and technology. During the year 2018-19, many new lab facilities such as HRTEM have been commissioned. The Prototype Gallery at the Centre hosting interactive technology displays based on in-house inventions, continues to attract a large number of academic and industry visitors to the campus. Extramural and industrial projects were undertaken during the year. Several workshops held jointly with neighbouring institutions and national and international organisations have enhanced research interactions and networking. During the reporting period, the Centre hosted the Trilateral Conference with participants from India, China and Singapore, on Advances in Materials: Energy, Water and Healthcare, CeNS, Bengaluru, during 22-24 October 2018.

The Centre, which is being constantly mentored by eminent scientists, administrators, policy makers, and in particular by the Nano Mission of the Government of India, has expanded its activities at the new campus, **Arkavathi,** located at Shivanapura, Bengaluru North.

DIRECTOR

1. INTRODUCTION

Centre for Nano and Soft Matter Sciences (CeNS), an autonomous research institute under the Department of Science and Technology (DST), Government of India, is a registered scientific society in Karnataka. DST provides core support to the Centre in the form of a grant-in-aid for conducting basic and applied research in Nano and Soft matter sciences.

The Centre is engaged in materials research at all relevant length scales. Specifically, the activities are focussed on a variety of metal and semiconductor nanostructures, liquid crystals, gels, membranes, and hybrid materials. It has close interactions with many Institutions and Industries, in India and abroad.

The Centre then known as Centre for Liquid Crystal Research was established in 1991 by an eminent liquid crystal scientist, Prof. S. Chandrasekhar, FRS. In 1995, it became an autonomous institute under the Department of Electronics, Government of India, and in 2003, was brought under DST. Subsequently, in the year 2010, the name was changed to Centre for Soft Matter Research. Recently in 2014, the Centre has further widened the scope of research activities to embrace nanoscience and technology and is now known as Centre for Nano and Soft Matter Sciences (CeNS). It is being mentored by the Nano-Mission of the Government of India.

CeNS is currently located at Jalahalli, Bengaluru. A laboratory block, on its new campus at Shivanapura, Bengaluru North Taluk, on a 14 acres land allotted by the Government of Karnataka, is ready for occupation. The Centre also has set up incubation units with basic facilities for fostering technology development activities.

With the extended responsibility, CeNS has renewed its vision to work in pursuit of Global excellence in Science and to nurture Indigenous Technology for the betterment of Our Country.

2. GOVERNING COUNCIL

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Hauz Khas, New Delhi - 110 016

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New Mehrauli Road, New Delhi – 110 016

Shri B. Anand, IAS — Member (Ex-Officio)
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Department of Science and Technology
Technology Bhavan, New Mehrauli Road
New Delhi – 110 016

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Professor
Solid State and Structural Chemistry Unit
Indian Institute of Science
Bengaluru – 560 012

Professor Amlan J. Pal — Member
Senior Professor
Indian Association for the Cultivation of Science
2A & 2B Raja S C Mullick Road
Kolkata 700032

Shri V. Mahesh — Member
Director (R & D)
Bharat Electronics Limited
Outer Ring Road, Nagawara
Bengaluru – 560 045

Professor G.U. Kulkarni — Member-Secretary
Director
Centre for Nano & Soft Matter Sciences
Jalahalli, Bengaluru – 560 013

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   Saha Institute of Nuclear Physics, Kolkata

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6. Professor Satishchandra Ogale — Member
   Emeritus Professor
   Indian Institute of Science Education and Research–Pune

7. Professor G.U. Kulkarni — Convener
   Director, Centre for Nano and Soft Matter Sciences

4. SCIENTISTS AND ADMIN STAFF

	Name	Designation
1.	Prof. G. U. Kulkarni	Director
2.	Prof. K. A. Suresh	Honorary Professor
3.	Dr. S. Krishna Prasad	Scientist G
4.	Dr. Geetha G. Nair	Scientist E
5.	Dr. D. S. Shankar Rao	Scientist E
6.	Dr. Veena Prasad	Scientist E
7.	Dr. C. V. Yelamaggad	Scientist E
8.	Dr. S. Angappane	Scientist E
9.	Dr. P. Viswanath	Scientist D
10.	Dr.Neena Susan John	Scientist D
11.	Dr.Pralay K. Santra	Scientist D (on contract)
12.	Dr. H.S.S.R. Matte	Scientist C (on contract)
13.	Dr. Uma S. Hiremath	WoS-A Scientist (under project)
14.	Dr. Ashutosh K. Singh	Scientist C (under project)

	Name	Designation
1.	Mr. Subhod M. Gulvady	Administration and Finance Officer
2.	Mr. Vivek Dubey	Accounts Officer
3.	Ms. P. Nethravathi	Assistant Admn. Officer
4.	Dr. Sanjay K. Varshney	Technical Assistant
5.	Mr. Sandhya D. Hombal	Technical Assistant
6.	Mr. M. Jayaram	Assistant
7.	Ms. Nayana .J.	Library Assistant
8.	Mr. Samuel V. Hebich	Support Staff (Retired on 28.02.2019)
9.	Mr. Jayaprakash V.K.	Support Staff

Consultants on Contract

	Name	Designation
1.	Mr. R. S. Gururaj	Consultant - Administration
2.	Mr. K. S. Chandrashekhar	Consultant Engineer
3.	Mr. Narayana M.G.	Consultant - Administration
4.	Dr. M.L.V. Archana	Authorised Medical Officer
5.	Mr. Ravishankar Solanki	Consultant – Computer Networking
6.	Mr. Deepak S.	Admn. Asst. (Public Relations)
7.	Mr. Noormuthu H.	Consultant (Internal Audit and Accounts)

5. RESEARCH AND DEVELOPMENT ACTIVITIES

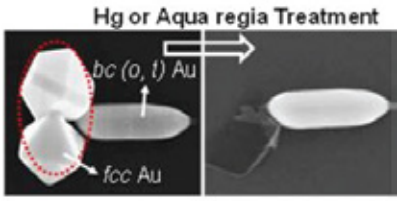
Twisted multilayer graphene exhibiting strong absorption bands induced by van Hove Singularities

Twisted bilayer graphene exhibits several angle dependent properties due to the emergence of the van Hove Singularities in its density of states. In this study, we use highly decoupled twisted multilayer graphene to observe twist angle-dependent optical absorption in the visible region using a simple spectrometer. A large number of twisted graphene layers in the system enables observation of such absorption evident in the visible region, the absorption band position correlates with the twist angle measured using selective area electron diffraction pattern as well as predictions from theory. While the Raman spectra were akin to decoupled graphene system, at a specific twist angle of ~13°, the spectrum contained clear signatures of G-band enhancement. *See: Bull. Mater. Sci 41, 130 (2018).DOI: 10.1007/s12034-018-1648-5*

Investigators: Umesha Mogera and G.U.Kulkarni

Nobler than the Noblest: Noncubic gold micro crystallites

Conventional gold comprised of cubic lattice is universally praised for its stability. However, well known to chemists and metallurgists, this nobility is challenged by reagents such as aqua regia, which dissolve gold to form salt solution.



Among metals, Hg blends with gold to form amalgam, otherwise transition metals such as Cu, tend to interact with with gold surfaces in electrochemical media. Herein, we report a combined experimental and theoretical investigation of the stability of Au microcrystallites bearing unconventional crystal lattices that exhibit enhanced stability towards Hg and aqua regia and practically no interaction with Cu during electroless plating. The unconventional gold is undoubtedly nobler *See: AngewandteChemie-International Edition 57(29), 9018 (2018)*

Investigators: G. U. Kulkarni

Collaborators: G. Mettela and C. Sow, JNCASR, Bengaluru; S. Kouser and S. T. Pantelides, Dept. of Physics and Astronomy, Vanderbilt University, USA

Parallel cracks from a desiccating colloidal layer under gravity flow and their use in fabricating metal micro-patterns

Desiccating cracks in random networks have been gaining importance as templates for metal deposition to produce transparent conducting electrodes (TCEs). The method being essentially lithography-free, a control over crack formation would simply translate to desirable opto- electronics properties in the patterned meshes. Herein, we report a simple, instrument-free scalable technique to produce parallel crack patterns in the desiccating layer using film thickness gradient formed under gravity flow of a colloidal dispersion on an inclined substrate. Finally as an example of patterning in desired regions, laser printed stripes on PET have been employed to produce confined geometry thereby leading stripes of parallel grating structures. *See: Phys. Chem. Solids, 118, 232 (2018) DOI: 10.1016/j.jpcs.2018.03.020*

Investigators: I. Mondal and G. U. Kulkarni

Collaborators: A. Kumar, JNCASR;K.D.M. Rao, Indian Association for Cultivation of Science, Kolkata

Cosmetically adaptable transparent strain sensor for sensitively delineating patterns in small movements of vital human organs

Monitoring live movements of human body parts is becoming increasingly important in the context of biomedical and human machine technologies. The development of wearable strain sensors with high sensitivity and fast

response is critical to address this need. Here, the fabrication of a wearable strain sensor made of a Au micromesh partially embedded in polydimethylsiloxane substrate, is described. The sensor exhibits a high optical transmittance of 85%. The effective strain range for stretching is 0.02%–4.5% for a gauge factor of over 10^8. High repeatability as well as cyclic stability has been demonstrated in live examples involving human body activity, importantly while mounting the sensor in strategic remote locations away from the most active site where strains are highest. *See: ACS Appl. Mater. Interfaces, 10, 44126 (2018).*

Investigators: Kulkarni G. U.

Collaborators: Gupta N, Srivastava K and Kumar A, JNCASR; Rao K. D. M., Indian Association of Cultivation of Science; Gupta R., Indian Institute of Technology Jodhpur; Marconnet A., Purdue University, USA and Fisher T. S., University of California, USA

Graphene–Ni(111) synergy influencing crystalline orientation, grain morphology and magnetic properties of Poly-Ni

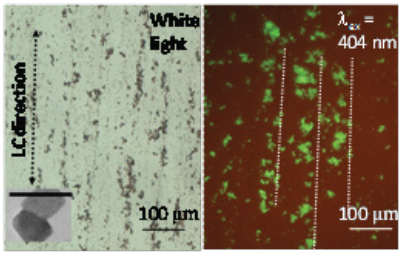
Among many metal catalyst surfaces, graphene growth on Ni(111) is highly facile owing to the least lattice mismatch between the two. Although the influence of crystalline orientation of Ni on the quality and properties of graphene is known, the effect of this growth on the catalyst surface is not well studied. In the present study, we have investigated this aspect by growing twisted multilayer graphene on polycrystalline Ni foil by a modified CVD process and examined the Ni surface carefully by employing a host of experimental techniques. X-ray diffraction measurements clearly indicate enhancement in the (111) orientation following graphene growth which is corroborated by the electron backscatter diffraction maps. There is an overall increase in the grain size as well, as evidenced by electron microscopy. Further, the ferromagnetic Curie temperature of Ni exhibits a downward shift of up to ~80 K as also does saturation magnetization, by ~0.06 μB. The changes in properties are accompanied by unusual morphological events on the Ni surface which include sharpening and interlocking of grain boundaries and cleavage formation. The above observations clearly point to a synergetic effect that manifests at the graphene–Ni(111) interface, the twisted layers only amplifying the effect. *See: Phys. Chem. C, 122 (25), 13962, (2018) DOI: 10.1021/acs.jpcc.8b01119*

Investigators: G. U. Kulkarni

Collaborators: Mogera U. and Sundaresan A., JNCASR, Bengaluru

Anisotropic fast electrically switchable emission from composites of CsPbBr3 perovskite quantum cuboids in a nematic liquid crystal

We observe fast electrically switchable anisotropic photoluminescence from a nano-soft composite comprising a nematic liquid crystal (LC) and quantum cuboids of a cesium lead halide perovskite. The magnitude of the anisotropy in emission appears to be dictated by the anisotropy of the LC and the capability of the cuboids to form a linear chain, the latter being evidenced through optical and electron microscopy. Application of an ac electric field of small amplitude and its consequent coupling to the LC director has been employed to continuously vary the magnitude of the green emission. By appealing to a two-frequency protocol the emission could be alternated between the anisotropic limits 40 times faster than with a standard protocol. These studies assume importance to obtain backlight sources having narrow FWHM and polarized emission for achieving high-quality low-cost LC displays. *See: Advanced Optical Materials, 7, 1801408 (2019), 10.1002/adom.201801408*



Investigators: Pragnya Satapathy, Pralay K. Santra, Anamul Haque, C.V. Yelamaggad, and S. Krishna Prasad

Collaborators: Shyamashis Das, Indian Institute of Science, Bengaluru

Graphene-augmented polymer stabilization

Polymers reinforced with nanofillers, specifically graphene in recent times, have continued to attract attention to realize novel materials that are low cost and better properties as well. At a different level, encapsulating liquid crystals (LCs) in polymer networks not only adds mechanical strength, but could also result in devices based refractive index mismatch where in we can get the scattering and transparent states of the device. The PSGLC device with a seven fold reduction in threshold voltage along with its temperature invariance behaviour and enhanced contrast ratio between field-off scattering/field-on transparent states opens up its route as new generation display. These observations open up anew vista for polymer-graphene composites in the area of device engineering, including substrate-free smart windows. *See: ACS Omega, 4, 403 (2019)*

Investigators: Marlin Baral, Bramhaiah Kommula, Neena S.John and S. Krishna Prasad

Confinement-driven radical change in a sequence of rotator phases

The effect of finite size restrictions, not on the molecular size, but on the possibility to form lamellar domains, combined with the inherent flexibility of the normal alkane, tetracosane (C28) chains led to increased molecular disorder as the molecules are squeezed into increasingly smaller spaces (from 200 to 25 nm). The final situation is analogous to a semi-crystalline polymer consisting of crystalline /ordered lamellae surrounded by an amorphous medium. Thus, nanoconfinement could be effectively employed as a strategy for controlled disorder by tuning the finite size and surface effects by varying the dimension of spatial confinement and appropriately functionalizing confining surfaces. *See: Phys. Chem. Chem. Phys. 20, 24345 (2018)*

Investigators: S. Dutta and S. Krishna Prasad

Nanometer confinement-driven promotion and stabilization of a hexatic phase intervening between ordered rotator phases

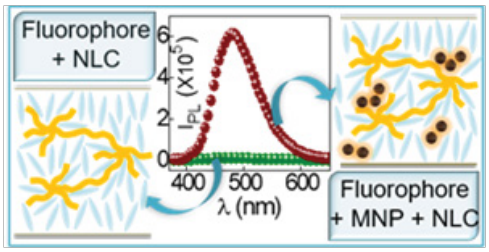
Through confinement in cylindrical alumina pores, and by surface anchoring, we are able to restrict the three dimensional degree of freedom possessed by the lamellar axis of molecular layers in their bulk state to two dimensions in the plane parallel to pore axis, thus giving rise to a system with significant residual stress between lamellar domains. The emergence of molecular disorder at the onset of hexatic phase quickly capitalizes on the existing residual stress analogous to crack propagation in glassy systems, thus leading to an abrupt loss of long-range molecular order, leaving behind only local order between individual hexagonal arrangement of molecules characterizing the hexatic phase in confinement. *See: J. Phys. Chem. B, 122, 10953 (2018)*

Investigators: S. Dutta, S. Srikantamurthy and S. Krishna Prasad

Collaborators: P K. Mukherjee, Govt. College of Engg. and Textile Technol., Serampore

Giant enhancement and facile tuning of photoluminescence in a soft anisotropic magneto-gel

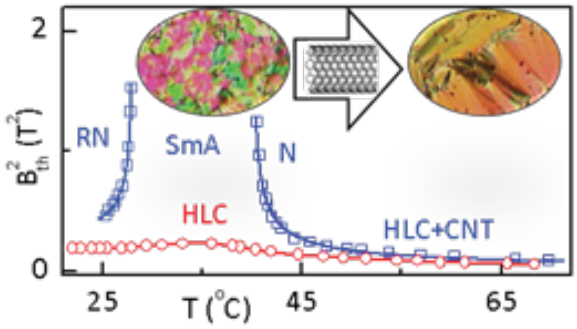
A photoluminescent (PL) nematic liquid crystal gel exhibits nearly two orders of magnitude increase in PL emission on addition of superparamagnetic nanoparticles. An internal 'magnetic field effect (MFE)" generated due to the magnetic nanoparticles is responsible for the enhancement.The nematic nature of the host medium aids in switching the emission between its anisotropic limits on application of a small external ac electric field. The switching between the two states is highly reproducible and repeatable, with the switch-off response time being faster compared to the field-driven switch-on time. *See: Nanoscale, 10, 15686-15695, (2018)*



Investigators: Vaisakh V M and S Vimala

Collaborators: Achalkumar, Ammathnadu S, IIT Guwahati, Guwahati, Assam

Nanophase segregation of nanostructures



Although representing drastically different chemical nature and type of interactions, the similarity of shape anisotropy of the constituents has created much interest in composites of calamitic liquid crystals (HLC) and carbon nanotubes (CNT). We report here that a small concentration of CNT doped to a "nematic mesophase only" material not only induces the layered smectic A(Sm A)mesophase, but leads to the nematic (N)-smectic-nematic re-entrant (RN) sequence as well, demonstrating the delicate interplay between the two entities. *See:J. Phys. Chem. B, 122, 10774 (2018)*

Investigators: G. V. Varshini, D. S. Shankar Rao, and S. Krishna Prasad

Collaborators: P. K. Mukherjee, Government College of Engg & Textile Technology, Serampore.

Suppression of the reentrant nematic and stabilization of the smectic phases by carbon nanotubes

We have carried out the optical, dielectric and Xray investigations on composites of a liquid crystal (LC) exhibiting the nematic-smectic-nematicreentrant (N-SmA-RN) sequence, with small concentrations of carbon nanotubes (CNT). The large aspect ratio (~250) CNT favour the smectic phase over the reentrant nematic: for the 0.5% CNT composite the SmA-RN transition temperature gets lowered by 11 K, whereas the high temperature N-SmA boundary is hardly affected. The carbon nanotubes encourage a stronger antiparallel coupling between the neighbouring dipoles, a feature that gets reflected in the dielectric data in the mesophase as well as in the isotropic phase, and corroborated by Xray studies. Magnetic field driven Freedericksz transformation measurements bring out the influence of CNT on the splay and bend Frank elastic constants, with the former exhibiting a large enhancement. The magnetic field-changeable electrical conductivity of the medium is proposed as a possible conductivity switch. *See:Journal of Molecular Liquids (2019 in press)https://doi.org/10.1016/j.molliq.2019.04.135*

Investigators: G. V. Varshini, D. S. Shankar Rao, and S. Krishna Prasad

Collaborators: : P.K. Mukherjee, Government College of Engg.& Textile Technology, Serampore

Influence of ZnO nanoparticles on the polarization, dielectric and electro-optic behaviour in the smectic C* and hexatic I* phases

Here we report the results of the dielectric and polarization measurements in the smectic and the tilted hexatic phases of a liquid crystal-nano composite consisting of commercially available ferroelectric liquid crystal (FLC) doped with the ZnO nanoparticles (NPs). The inclusion of NPs not only decreases in the transition temperature but also dielectric strength of the Goldstone mode without altering the associated relaxation frequency. The composite shows decreased rotational viscosity and a faster response time, a feature attractive from an application point of view. *See:Journal of Molecular Liquids275 421-430 (2019)*

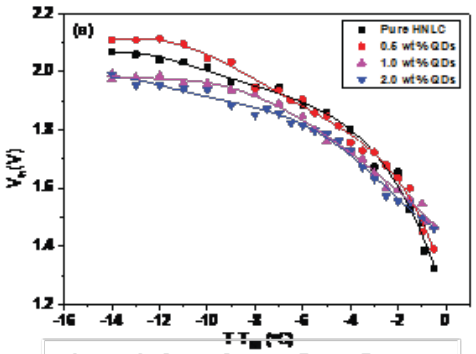
Investigators: S. Krishna Prasad and D.S. Shankar Rao

Collaborators: K. L. Sandhya, N. Pushpavathi, Department of Physics, Ramaiah Institute of Technology, Bengaluru

Quantum dots dispersed hockey stick nematic liquid crystal: studies on dielectric permittivity, elastic constants and electrical conductivity

Effect of doping of octadecylamine functionalized CdSe/ZnS core-shell quantum dots (QDs) on the physical properties of a hockey stick nematic liquid crystal (HNLC) has been investigated. The doping of QDs into HNLC resulted in the reduction of the Vth. For

the low concentrations of QDs, the $\Delta\varepsilon$, K_{11} and K_{33} are slightly reduced. However, significant effect on these parameters was observed for the nanocomposite with 2 wt% QDs, especially in the frequency dependent dielectric permittivity measurement. The frequency associated with relaxation process due to the electrode polarization effect increases with increasing concentration of QDs. The addition of QDs leads to an increase in the conductivity of HNLC by more than an order of magnitude. Thus, one can use QDs to fine tune the physical properties of LC materials which are of importance from application point of view. *See: J. Mol. Liq., 266, 10 (2018)*



Thermal dependence of V_{th} for pure HNLC and its nanocomposites with QDs

Investigators: Jitendra Kumar, Veena Prasad and Monika M.

Highly frustrated liquid crystals for basic and applied sciences

Four new series of chiral, nonsymmetric dimers in which cholesterol has been covalently linked to a Schiff base core through an -oxyalkanoyloxy spacer have been realized and characterized. The length and parity of spacer, and the length of the terminal tail play vital role in deciding the phase sequences of the dimers. The dimers with even-parity spacer show enantiotropic mesophases such as chiral nematic (N*), twist grain boundary (TGB) smectic A, chiral smectic C and twist grain boundary phase with SmC* slabs (TGBC*) . The dimers with an odd-parity (5-oxypentanoyl) spacer display, unlike their even-membered counterparts, blue phases (BPs); besides, they stabilize N* and / or an unknown smectic (SmX) phases. The occurrence of a negative CD band in the N* phase of the even-dimers suggest left-handed screw sense of the helical structure and the scenario is opposite in the case of an odd-dimer. *See: New J. Chem., 43, 2148-2162 (2019)*

Investigators: Sachin A. Bhat and C. V. Yelamaggad

Collaborators: G. Shanker, Department of studies in Chemistry, Bengaluru University; Rashmi Nayak, CSIR-National Chemical Laboratory, Dr. Homi Bhabha Road, Pune

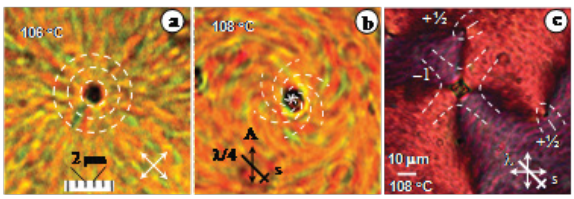
Technically significant chiral nematic phase at room temperature

Stabilization of the chiral nematic phase at room temperature in single component chiral mesogens is highly challenging where the molecular designing is rather crucial, and thus scarcely reported. Working in this direction, rational designing, synthesis and characterization of new chiral non-symmetric dimers exhibiting N* phase over a wide thermal range including room temperature have been accomplished. The varition in selective reflection colors as a function of temperature in the N* phase of the dimers occurs confirms the suitability of these materials in thermal sensors. *See:J. Mol. Liq. 275, 849-858 (2019)*

Investigators: C. V. Yelamaggad

Collaborators: G. Shanker, A. Bindushree, K. Chaithra, P. Pratap and R. K. Gupta, Department of studies in Chemistry, Bengaluru University ; A. S. Achalkumar, Department of Chemistry, Indian Institute of Technology Guwahati.

Microscale structures arising from nanoscale inhomogeneities in nematics made of bent shaped molecules



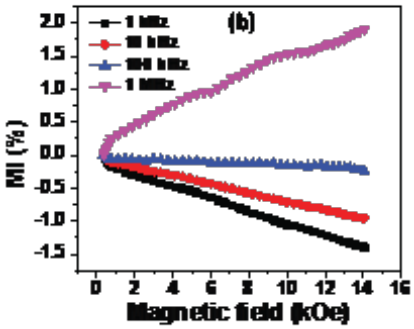
Nano-scale structures in fluid media normally require techniques like freeze fracture electron microscopy and atomic force microscopy for their visualization. As demonstrated in the present study, the surface modification of nanoscale clusters occurring intrinsicallyin nematics made of bent shaped molecules with either rigid or flexible cores leads to

micro-scale structures, which are visible in an optical microscope. The resulting pattern of stripes outlinesthe director-normal field around line defects in the well-known schlieren texture. The instability, which is seen over most of the nematic rangesets the nematics made of bent shaped molecules apart from the classical nematics of rod-shaped molecules. *See: J. Phys. Chem. B, 123, 1423-1431 (2019)*

Investigators: K.S. Krishnamurthy, Madhu B. Kanakala, C. V. Yelamaggad

Collaborator: N. V. Madhusudana, Raman Research Institute, Bangalore

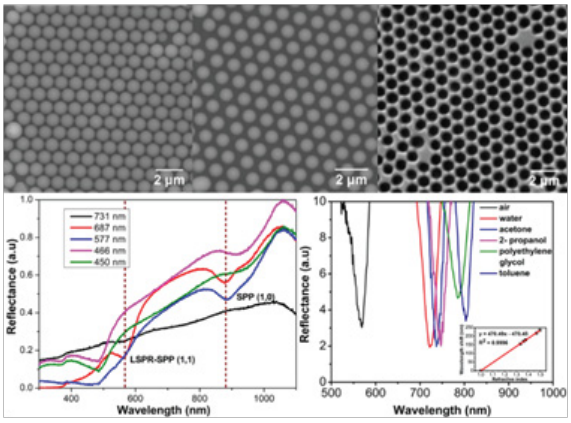
Extraordinary ferromagnetic coupling and magnetodielectric phenomena in NiO nanoparticles



Themagnetic studies of NiO nanoparticles of average size ~ 23 nm synthesized by chemical route revealed that the nanoparticles are weakly ferromagnetic (FM). Notably, temperature dependent magnetization studies show a bifurcation of the FC-ZFCmagnetizationcurves, suggesting a competition between FM and antiferromagnetic interactions with blocking temperature (T_B) at ~210 K. Additionally, we observed field dependent exchange bias effect in the nanoparticles. Further magneto-dielectric studies revealed that the changes in the dielectric constant and loss induced by the magnetic field are strongly frequency-dependent, which originates from combined effect of extrinsic Maxwell–Wagner polarization along with magnetoresistance. It was found that the magneto impedance changes sign from negative at low frequencies to positive at higher frequencies of excitation signal. *See:IEEE-Trans. Magn. 55, 1 (2019)*

Investigators: Subir Roy, Rajesh Katoch and S. Angappane

Impact of ordering of gold nanohole arrays on refractive index sensing



Gold nanohole arrays of various hole sizes with fixed thickness were fabricated using colloidal lithography. The degree of ordering of gold nanohole arrays was obtained by using a pair correlation function and a bond-orientation order parameter. Reflectance studies show signatures of surface plasmon polaritons and their coupling with localized surface plasmon resonance (LSPR). Spectral resolution of resonances is evaluated and found to improve with long-range ordering and a higher bond-orientational order parameter of nanohole arrays. Optimal sample exhibiting coupling of LSPR and surface plasmon polaritons is chosen for refractive index sensing, yielding sensitivity of 470.49 nm/RIU and figure of merit of 14.42. *See:Journal of Optical Society of America B 35:2501 (2018)*

Investigators: Brindhu Malani S and P. Viswanath

All organic nanocomposite of a ferroelectric polymer and metallo-phthalocyanine.

Organic nanocomposites permit one to tune the dielectric properties by controlling the crystallinity and surface morphology. Here, we report investigation on metallophthalocyanines of nickel and copper as an organic additive (fillers) to poly(vinylidene fluoride) (PVDF). We study the structural, optical, wetting, and electrical properties of the nanocomposite multilayers deposited using Langmuir-Schaefer method. The incorporation of the metallophthalocyanines in the nanocomposite multilayers was confirmed from the signature

Bragg peaks, and the fingerprint absorbance using grazing incidence X-ray diffraction and FTIR spectroscopy, respectively. In addition, these studies also reveal the nature of polymorph in the nanocomposites. A significant enhancement in the dielectric constant has been observed for both nanocomposites relative to the pristine multilayer of PVDF. *See: Journal of Applied Polymer Science 136:47818, 2019. DOI: 10.1002/app.47818*

Investigators: Chandan Kumar and P. Viswanath

MoO_3 sea urchin structures for Surface Enhanced Raman Spectroscopy (SERS) of dyes

Novel sea-urchin morphology of MoO_3 is synthesized employing chemical bath deposition and consists of 20-40 micron structures possessing hundreds of ~15 μm long spikes with 20 nm sharp tips originating from the core. SERS of rhodamine 6G (R6G) over MoO_3 sea-urchins exhibit higher activity with enhancement factor (EF) of the order 105 and detection limit of 100 nM while the corresponding values are 10^3 and 1 μM for 1D-h-MoO_3 nanorod arrays. The observed high EF is attributed to the enhanced charge transfer between analyte molecules and the substrate promoted by the oxygen vacancies along with surface defects and hydroxyl groups on sea-urchins providing more active sites for the adsorption of probe molecules. Raman mapping of a single sea urchin is achieved with good R6G intensity with tips of spiky features involved in SERS enhancement. The reusability of substrates is shown for repeated cycles of R6G adsorption by UV irradiation exploiting the photocatalytic activity of MoO_3. *See: Nanoscale Adv., DOI: 10.1039/C9NA00115H*

Investigators: Neena S John, Ramya Prabhu B., K Bramhaiah and Kaushalendra K Singh

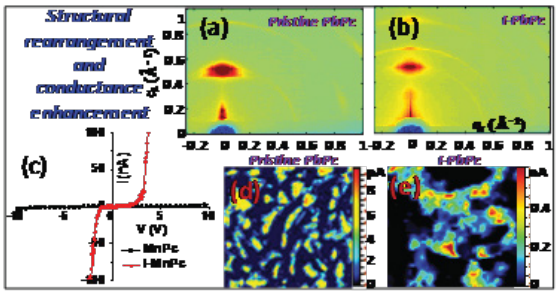
Films of nickel hydroxide nanowalls on reduced graphene oxide for supercapacitor and oxygen evolution applications

Free-standing films of reduced graphene oxide (rGO) based $Ni(OH)_2$ nanowall structures are generated at a liquid/liquid interface involving in situ reaction and self-assembly. The nanowall network with 10–15 nm wall thickness and ordered voids of average size 100 nm can serve as excellent candidates for catalyzing electrochemical oxygen evolution reaction (OER) as they expose maximum edge sites of $Ni(OH)_2$ and allow diffusion and penetration of electrolytes into voids enhancing the contact area of the electrolyte/electrocatalyst interface. The unique morphology of the hybrid films exhibited high electrochemical surface area and low charge transfer resistance. Accordingly, rGO $Ni(OH)_2$ films display excellent catalytic activity and high cycling stability in alkaline solutions giving a current density of 10 $mAcm^{-2}$ at an over potential of 378 mV with a Tafel slope of 56 $mVdec^{-1}$. The hybrid films also exhibited a high specific and areal capacitance of 1402 Fg^{-1} and 98.12 $mFcm^{-2}$ at a scan rate of 5 mVs^{-1} *See: ChemistrySelect, 4, 2519–2528 (2019)*

Investigators: Neena S John, K. Bramhaiah, C. Alex and V. N. Singh

Collaborators: Vidya N Singh, CSIR-NPL, New Delhi

Effect of iodination on molecular orientation and electrical properties in metallophthalocyanine thin films



Two-dimensional grazing incidence X-ray diffraction (2D-GIXRD) studies of pristine and iodine doped MPcs reveal that the ordered molecular packing undergoes rearrangement to give differently oriented and randomly arranged nanocrystallites with interstitial iodide species. The ferromagnetic interactions between the macrocycles of pristine MnPc molecules which exhibit thickness-dependent conductance transform to antiferromagnetic interactions and thickness-independent

conductance. 2D-GIXRD of pristine and iodine doped nonplanar PbPc films reveal similar structural changes and the nanoscale conductance mapping in iodine dopedPbPc films using conducting atomic force microscopy (C-AFM) reveal interconnected percolation pathways in contrast to the isolated conducting domains in the pristine films (See Figure). It is also shown that the competitive doping in PbPc films enhances the sensitivity towards analyte sensing by studying the effect of ammonia on the conductance of iodine doped PbPc films. *See:J. Phys. Chem. C, 122, 28075−28084 (2018)*

Investigators: K. Priya Madhuri, Neena S. John, S. Angappane, Pralay K. Santra

Collaborators: F . Bertram, DESY Photon Science, Hamburg, Germany

Internal heterostructure of anion exchanged cesium lead halide nanocubes (NCs)

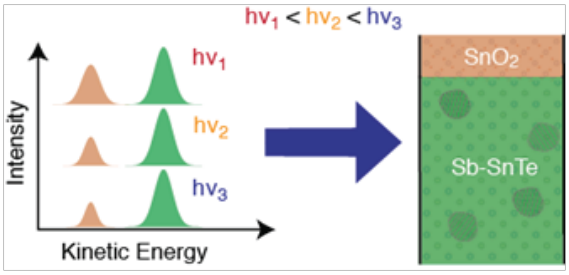
In this work, we elucidate the internal heterostructure of anion exchanged NCs using variable energy hard X-ray photoelectron spectroscopy. We reported that there is a significant inhomogeneity in the composition across the radius of NCs in contrast to a homogeneous alloy. The surface of CsPb $(Br/I)_3$ NCs is rich with exchanged iodide ions, whereas the core is rich with native bromide ions. *See: J. of Phy. Chem. C, 122, 13399 (2018).*

Investigators: Dr. Pralay K. Santra and Mr. Anamul Haque

Collaborators: Dr. Angshuman Nag, IISER-Pune, Pune

Understanding the chemical nature of the buried nanostructures in low thermal conductive Sb doped SnTeby Variable Energy Photoelectron Spectroscopy

In this work, we determined the chemical nature of the buried nanostructures of a series of Sb doped SnTe by variable energy X-ray photoelectron spectroscopy performed at synchrotron. First, we report that the different chemical species observed and how they vary with photon energy. Both Sn and Sb are found to be slightly oxidized in surface. From the intensity variation with photon energy, we have

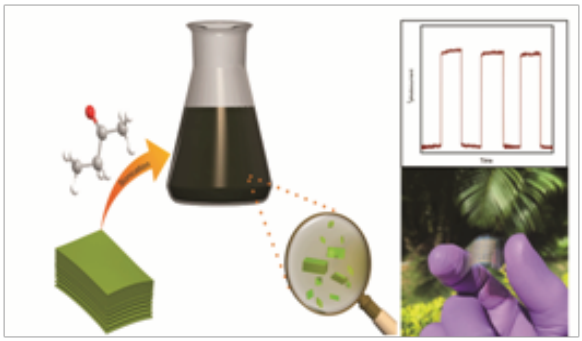


found a thin layer of SnO_2 (up to 4.5 nm) on the sample surfaces and the thickness decreases with Sb doping. Te is found in both -2 and 0 oxidation states which corroborates with the variation of Sn vacancies with Sb doping. The valence band features near the edge do not change significantly with Sb doping. *See: Journal of Physical Chemistry C,123, 10272, (2019)*

Investigators: Dr. Pralay K. Santra and Mr. Anamul Haque

Collaborators: Dr. Kanisha Biswas, JNCASR, Bangalore

Highly concentrated and stabilizer-free transition-metal dichalcogenide dispersions in low-boiling point solvent for flexible electronics



For the first time the use of 2-butanone (B.P. 80^0C) as an effective solvent for the exfoliation of transition metal dichalcogenides has been explored. Among these, MoS_2 has achieved dispersion concentrations, reaching values up to 5.5 mg ml^{-1}. The present study suggests that molecular interactions plays a critical role in achieving high efficiencies and provide an additional aspect to consider in solvent selection, along with Hansen solubility parameters. *See: Nanoscale, 2019, 10.1039/C9NR02019E.*

Investigators: Kenneth Lobo, Shivam Trivedi and H. S. S. Ramakrishna Matte

6. PUBLICATIONS

Total no. of Publications :

1) In Refereed Journals: 55
2) In conference Proceedings: 7
3) In Books: 1

Average Impact Factor: 3.42

No.	Journal	Publications
1.	ACS Appl. Mater. Interfaces	1
2.	ACS Omega	2
3.	Adv. Optical Mater.	1
4.	Angew. Chem. Int. Ed.	1
5.	Appl. Phys. Lett.	1
6.	Appl. Surf. Sci.	1
7.	Bioresour. Technol.	1
8.	Bull. Mater. Sci.	6
9.	Chem. Eur. J.	2
10.	ChemistrySelect	4
11.	IEEE-Trans. Magn.	1
12.	J. Phys. Chem. Solids	1
13.	J. Chem. Technol. Biotechnol.	1
14.	J. Lumin.	3
15.	J. Mater. Chem. C	1
16.	J. Med. Devices	1
17.	J. Mol. Liq.	6
18.	J. Nanopart. Res.	1
19.	J. Phy. Chem. B.	3
20.	J. Phys. Chem. C	4
21.	J. Supercond. Nov. Magn.	1
22.	J. Appl. Poly. Sci.	1
23.	J. Mol. Structure	1
24.	J. Optical Society of America B	1
25.	Liq. Cryst.	2
26.	Mater. Chem. Phys.	1
27.	Nanoscale	2
28.	New J. Chem.	3
29.	Phys. Chem. Chem. Phys.	1

Details shown in Annexure A

7. PATENTS

Total number of Patents: 7

No.	Title	Inventors	Patent Application No.
1.	A process for producing graphene, and application thereof	S.K. Choudhary, Sumitesh Das, G.U. Kulkarni and Rajashekhar N. Pujar	Indian Patent Application No. IN201621041721 Filing PCT under process.
2.	A Visibility Controlling Device	G. U. Kulkarni, A. K. Singh and Rahul M	Indian Patent Application No: 201841037142; Priority date: 01.10.2018
3.	Method of preparation of reduced graphene oxide (rGO)	S. K. Choudhary, S. Das, G. U. Kulkarni, M. Gedda and R. Pujar	Indian Patent Application No. 201831019387; Priority date: 23.05.2018
4.	Chiral plasmonic liquid crystalline gold nanoparticles and method thereof	C V Yelamaggad, Geetha G Nair, et al	Indian Patent Application No.: 201841001456; filed on 01-12-2018
5.	Method for rapid synthesis of porous and metallic MoO_2 nanostructures	Neena S. John	Indian Patent Application No.: 201841038753, filed on 12.10.2018
6.	A method of exfoliation of transition transition metal dichalcogenides and product there of	H.S.S Ramakrishna Matte, Kenneth Lobo, Shivam Trivedi	Indian Patent Application No.: 201841014328, filed on 16.04.2018; PCT Application Number: PCT/IB2019/053044 filed on 12.04.2019
7.	Graphene inks from pre-treated	H.S.S Ramakrishna Matte and Shivam Trivedi.	Provisional Patent filed on 12.03.2019

8. ENTREPRENEURSHIP ACTIVITIES

- A Material Transfer Agreement with UFLEX Ltd. was signed for a market survey and dated 24th August 2018.
- Translucent-Transparent Switching Glass: Tata Steel Ltd. has approached CeNS to develop a Prototype using the CeNS Invention of “A Visibility Controlling Device”.
- With Hind High Vacuum Co. Pvt. Ltd.an R&D project to prototype manufacturing of oxide coated metal mesh based transparent conducting plates.
- An NDA was signed with Indygo, Japan for “Smart Glass” and “Flexible displays” applications on 18 July 2018.
- An NDA was signed with Renault Nissan Technologies and Business Centre India PVT LTD (RNTBCI) to work on batteries dated 18th July 2018.
- In the process of consultation with Tata Solar BP to work on increasing the efficiency and stability of Li- and Na-ion batteries
- NoPo Technologies, a startup company on nanotubes has shown interest for consultation on separation of nanotubes.

- In discussion with Indian Oil Corporation Limited to study the lubrication properties of dispersed TMDC to look into possibilities of commercialization of the patent
- Discussion with M/s. Cavinkare Ltd. on usage of graphene inks/other nanomaterials in FMCG based products is in dialogue.
- CeNS participated at India International Science Festival (IISF)-2018 held during 5-8 October 2018 at Lucknow, UP, and showcased the R&D activities through demonstrable prototypes and posters.
- CeNS participated in 10th Bengaluru India Nano held during 5 – 7 December 2018 in Bengaluru. Various prototypes developed in CeNS were showcased, and PhD scholars and postdoctoral researchers presented a total of 12 posters at the event.
- **Prototype Gallery:** The gallery houses about fifteen demonstrable prototypes and attracts visitors from industry and academic institutes on a regular basis. Recently two more prototypes were added to the gallery. One is a water activation cell constructed with in-situ grown MoO_2 films on FTO as the electrocatalyst for hydrogen generation (HER). The other is Translucent - Transparent switching microfluidic glass (smart window).

HER protoype

- **TechBuddy:** A new R&D Programme 'From in-house Inventions to Prototype Development (FIPD)" was launched in April 2018 to hire 'TechBuddies' (candidates with engineering/science background) to assist researchers to translate the innovative lab-level research findings to commercially viable products.

9. TEACHING

No.	Course Title /New Modules	Credits
1.	Basics of Nano and Soft Matter Concepts and Definitions: nanoscale processes, nanosystems, important nanomaterials, historical account; Quantum confinement and Surface effects in nanosystems, Size-dependent properties-optical, electronic, magnetic and reactivity- I &II; Electronic structure of semiconductor, Photovoltaics – working principle, Synthesis of quantum dots and their characterization, Carbon Nanomaterials: Fullerenes, Nanotubes and Graphene; Analogues and Hybrids; Thermal analysis; Rheology of gels and Liquid Crystals, etc.	2:1
2.	Scientific Communication Manuscript preparation; Means of communicating scientific data, etc.	1:0
3.	Instrumental Methods & Analysis X-ray and nuclear methods; Electron microscopy and probe microscopy; Rheology etc.	1:1
4.	Intellectual Property	1:0
5.	Safety and Waste Management	1:1

10. EXTRAMURAL RESEARCH PROJECTS

COMPLETED

No.	Project	Sponsoring collaborative agency	Duration from - to	Budget sanctioned Rs. in Lakhs
1.	IUSSTF project on Nanomaterials for Clean Energy and Environmental Sensors	IUSSTF	2016-2018	21.76

ONGOING

No.	Title of the project	Duration from - to	Budget sanctioned Rs. in Lakhs
1	IGSTC project on "Nanostructured hybrid transparent network electrodes for large area visibly transparent solar cells (METNETWORK)" Sanction Order No. IGSTC/Call 2015/METNETWORK/07/2017-18/78 dt. 31.08.2016	2016-2019	185.50
2.	Thematic projects in frontiers of nano S&T (TPF-Nano) on "Chemical Physics of Functional Nanostructures and Interfaces" Sanction Order No.SR/NM/TP-25/2016 dt. 09.11.2016	2016-2019	1,115.00
3.	Tata Steel Advanced Materials Research Centre (TSAMRC)	2016-2021	872.00
4.	Nano Mission project "Transparent conducting glasses made of metal nanomesh coated with metal oxide overlayer and scaling their production to m2 area" SR/NM/NT-03/2016(G) dt. 23.08.2017 & SR/NM/NT-03/2016(C) dt. 23.08.2017	2017–2019	850.00
5.	SERB Project "Molecular design directed synthesis and characterization of inexpensive, functional organic materials exhibiting technologically relevant liquid crystal phases" Sanction Order No.EMR/2017/000153 dt. 17.08.2017	2017-2020	47.70
6.	SERB Project "Magnetic nanoparticles for memory applications" Sanction Order No. EMR/2016/005081dt. 24.07.2017	2017–2020	23.44
7.	CeNS-Centre for High Technology (CHT) Project "Scale up studies of hydrogen production from methane decomposition: Value addition from spent catalyst"	2017-2021	100.00
8.	SERB Project on "Development of band-engineered buffer layer at the interfaces of photovoltaic devices and study of its effect on charge recombination" Sanction Order No. CRG/2018/001698 dt. 10.05.2019	2019-2022	46.66
9.	WOS-A project "Synthesis of chiral liquid crystals and their composites with nanoparticles: Development of functional mesophases for applied science" Sanction Order No. SR/WOS-A/CS-134/2016 dt. 22.05.2017	2017–2020	22.8
10.	SERB Project on "Investigations of optical, electro-optical, and mechanical properties of liquid crystal based soft photonic composites" Sanction Order No. CRG/2018/000736 dt. 08.05.2019	2019-2022	42.5
11.	Nano Mission "Technology Business Incubator" Project Sanction Order No. SR/NM/TBI-01/2017(G) dt. 10.07.2019	2019-2022	518.56

11. NEW RESEARCH FACILITIES

New research facilities and equipment were added to Characterization lab (C-Lab), Devices & Interfaces lab (Di-Lab), and to Tata Steel Advanced Materials Research Centre (TSAMRC). During this period, two new laboratories were also set up.

Equipment

- Glass cleaning and template removal system
- Spin coater system
- ITO/AZO sputtering System
- Spray coating system
- Thermal evaporation system
- COMSOL multiphysics with wave optics module
- Electrochemical and photoelectrochemical based water splitting with gas chromatography detection
- External and internal quantum efficiency measurement system
- Surface area instrument
- Particles size analyzer at CeNS, Shivanapura Campus
- High resolution transmission electron microscope

Laboratories

- Energy lab
- Battery fabrication unit

12. OUTREACH PROGRAMME

12.1. V4: {dk⍾{Z-{dÚ⍾{W {dM⍾a {d{Z_`

With a view to stimulate and nurture scientific curiosity in the young minds, CeNS embarked on a science outreach programme aimed at high school, pre-university and university level students on 1st August 2015. Under this programme, in the last academic year, the Centre reached out to nearly 3,200 students who participated in innovative science learning activities which included lab tours, scientific talks and experimental demonstrations on its campus. Apart from this CeNS faculty visited various academic institutes/schools/colleges and conducted workshops /delivered lectures for the student community. Since its inception in August 2015, more than 11000 students from over 142 schools/colleges have benefitted from this programme.

Details shown in Annexure B.

12.2. Research Outreach Initiative Studentship (ROIS)

ROIS is a programme designed to provide research experience to highly motivated students pursuing post-graduate studies in Physical/Chemical Sciences or a relevant branch of Engineering/Technology. The goal of the programme is to identify brilliant students having a potential to pursue research as a career. During the year 2018-19, forty one students successfully completed various projects in research areas of Nano and Soft Matter Sciences.

The list is given in Annexure C.

13. Ph.D. & TECHNICAL TRAINING

Number of Ph.D produced: Awarded: 4 Submitted: 2

Sl. No.	Name of the Student	Ph.D	Date
1	Bramhaiah Kommula	Awarded	28.07.2018
2	S. Vimala	Awarded	12.04.2019
3	Srividhya Parthasarathi	Awarded	25.04.2018
4	Mr. Arup Sarkar	Awarded	12.04.2019
5	Mr. Chandan Kumar	Submitted	26.10.2018
6	Veerabhadraswamy B.N.	Submitted	25.10.2018

Ph.D. students (pursuing)

Senior Research Fellow
Alex C.
Anamul Haque
Brindhu Malani S
Gaurav Shukla
Indrajit Mondal
Madhu Babu Kanakala
Marlin Baral
Prashanth Nayak
Priya Madhuri K.
Rajashekhar N. Pujar
Sachin Ashok Bhat
Subir Roy
Suman Kundu
Sunil Walia
Varshini G.V.

Junior Research Fellow
Amit Bhardwaj
Amit Kumar Patel
Athira M
Gayathri R. Pisharody
Kenneth Lobo
Muhammed Safeer N.K.
Nurjahan Katun
Pinchu Xavier
Priyabrata Sahoo
Rajalaxmi Sahoo
Ramesh Chandra Sahoo
Suchithra P
Swathi S.P.

Research Associates
Dr. Vivek Ramakrishnan
Dr. Jitendra Kumar
Dr. Remya K. Govind
Dr. P. Chithaiah
Dr. Rajesh Katoch
Dr. Sreejesh M.
Dr. Vaishali Sharma
Dr.Navas M.P.
Dr. Anil Kumar Astakala
Dr. Sujeet Dutta (N-PDF)
Dr. Rithesh Raj D. (N-PDF)
Dr. Rajasekhar Yerrasani (N-PDF)
Dr. Umesh Mogera (under Project)
Dr. C. Sathiskumar (under Project)
Dr. Arup Sarkar (Provisional RA)
Ms. S.Vimala (Provisional RA)
Mr. Chandan Kumar (Provisional RA)

R&D / Technical / Project Assistants
Sundaram R
Bramhaiah Kommula
Hiran J Lal
Kanaka Deepthi Voora
Kaushik Baishya
Keerthan Acharya
Lavanya B. (Safety Mgt.)
Madhanmohanraju S
Math Shivalingayya
Melzita Joyline D' Souza
Navyashree V
Sanjith Kumar Parida
Sharadhi N. Raj
Shekh Saddam Husen
Shivam Trivedi
Nikita Madhukar

Project Assistants

Reetu K, R&D Asst., TSAMRC Project	S Vimala Research Personnel, SERB Project
Bikesh Gupta , R&D Asst., CHT Project	Bhavin Naik, JRF, SERB Project
Srividya Adiga, R&D–Marketing, NMNT Project	Mukhesh K.G, R&D–Technical, NMNT Project
Rajalakshmi R, Consultant (Publications), TSL Project	Vanitha B, Project Co-ordinator

Tech Buddy

Rahul M

Visiting Faculty

Dr. A. Pradeep
Dr. Shridhar M.P.
Dr. Gurumurthy S.C.

Visiting Students

Mr. Sankalp Choudhuri
Ms. Sahana Naik
Ms. Nithyashree B
Ms. Anusha Dsouza
Mr.Dhiraj Kumar Rana, NIT Durgapur
Mr. V. Durga Shankar, Anna University

14. EVENTS AT CeNS

• The **World Intellectual Property Day**, was celeberated with a talk titled 'Creating an innovation ecosystem for translating basic research to commercial products', by Mr. R. Sundaram, Project Officer (R&D) on 26 April 2018.

• CeNS Library organized a **Book Exhibition** on the campus by inviting M/s. Tata Book House, IISc Campus, Bengaluru, during 3-4 May 2018. Scientific books related to Physics, Chemistry, Soft Matter and Nano Science and Technology (National and International Publications) were displayed.

• On the occasion of Swachhta Pakhwada, on 9 May 2018, Dr.C.V.Yelamaggad, CeNS faculty spoke on 'Awareness, objectives and importance of the 'Swachhta Pakhwada-2018'. The students and staff participated in a short-presentation competition with the theme 'Cleaning and Hygiene' on 10 May 2018. A lecture titled 'Plastic Waste Management' by Dr.Manjunatha M., Research Scientist, EMPRI, Bengaluru was arranged on 15 May 2018. A mass campus cleaning was also taken up by CeNS community during this week keeping with the spirit of pledging.

• A Hindi version of the CeNS website was launched in the month of June 2018.

• On the occasion of **International Yoga Day,** Ms. Sneha, International Yoga Trainer of Isha Foundation, Bengaluru, gave a lecture demonstration on yoga on 21 June 2018 at CeNS.

• **Independence Day** was celebrated at CeNS on 15 August 2018 with the National Flag hoisting by the Director. This was followed by a sports event.

• **Fresher's Day** was held on 23 August 2018 to welcome the new Ph.D. students.

• To commemorate the birth anniversary of Sardar Vallabhbhai Patel as **Rashtriya Ekta Diwas (National Unity Day)**, all members took the National Unity Pledge on 31 October 2018.

• The Centre observed the **Vigilance Awareness Week** during 29 October 2018 to 3 November 2018. The faculty and administrative staff took a pledge on vigilance. The Centre also arranged a talk on this year's theme "Eradicate Corruption-Build a New India (^îQmMma {_QmAm Z`m ^maV ~mZmAm)", by Shri C. Selva Kumar, Deputy General Manager, Bharath Electronics, Bengaluru on 2 November 2018.

• On the occasion of **Kannada Rajyotsava,** a more inclusive programme titled "Rashtrotsava" was celebrated on 15 December 2018 wherein multilingual events were presented by CeNS community hailing from various parts of the country. The events con sisted of songs rendition, essay competition, music, skit, quiz etc.

15. HONOURS & AWARDS

15.1. AWARDS

- SASTRA-CNR Rao Award for Excellence in Chemistry & Materials Sciences (2019 - 20), Prof. G.U. Kulkarni
- MRSI-Distinguished Lectureship Award (2019-20), Prof. G.U. Kulkarni
- MRSI Medal (February 2019), Dr. C.V.Yelamaggad
- FRSC (Fellow of the Royal Society of Chemistry), Royal Society of Chemistry, London, Dr.C.V.Yelamaggad.
- 'Certificate of Reviewer Excellence 2017' award in recognition of outstanding contributions as a Reviewer for the Bulletin of Materials Science, Dr.S.Angappane.

15.2. HONOURS

S. Krishna Prasad

- Member, Program Advisory Committee, SERB

Geetha G Nair

• Member, Board of Studies, Master Course in Materials Science (PG), University of Mysore

15.3. POSTER AWARDS

- Suman Kundu, SRF, won "Best Poster Award" at the International conference onFrontiers in Materials from Basic Science to Real time Applications, CNMS, JAIN University, 13 March 2019.
- Indrajit Mondal, SRF, won "Best Poster Award" at the International Conference on Nano Science and Technology (ICONSAT-2018), CeNS, Bengaluru, 21-23 March 2018
- Brindhu Malani S, SRF, won "Best Poster Award" in Topical Meeting on Advances in Photonics (TMAP, 2019) conducted at the National Institute of Science Education and Research, Bhubaneshwar 29-30, March 2019
- Pragnya Satapathy, SRF, won "Best Poster Award" at the 9th MRS Trilateral Conf. on Advances in Materials: Energy, Water and Healthcare, CeNS, Bengaluru, 22-24 October 2018
- Vivek Ramakrishnan, RA, won "Best Poster Award" at the MRS Trilateral Conf. on Advances in Materials: Energy, Water and Healthcare, CeNS, Bengaluru, 22-24 October 2018
- Amit Bhardwaj, JRF, won the "Best Poster Award" for his presentation at the 10th Bengaluru INDIA Nano, 5-7, Dec 2018, Bengaluru.

16. RESERVATION

The Centre follows the national policies on Reservation as per the rules and orders issued by the Government of India from time to time. The Centre has one SC/ST employee working under Group C.

17. OFFICIAL LANGUAGE

Hindi Pakhwada

On the occasion of Hindi Pakhwada, several programmes were conducted during 12-26 September 2018. The programme consisted of Hindi translation, Hindi Typing, Debating Competition, Hindi Short Articles (for non-Hindi speaking people), Sentence construction and lecture etc. have been organized. Lecture was given on the “development of Hindi” by Shri Rajinder Kumar Sharma, Assistant Director (in-charge) Central Hindi Training Institute. The prizes for the competitions organized, were distributed after the lecture.

Also to popularize usage of Hindi at CeNS, a scientific word is displayed everyday on the Notice Board under "AmO H m eãX".

18. AUDITED STATEMENT OF ACCOUNTS

B.R.V. Goud & Co.
Chartered Accountants

INDEPENDENT AUDITORS' REPORT

TO THE MEMBERS OF THE GOVERNING BODY OF CENTRE FOR NANO AND SOFT MATTER SCIENCE, BANGALORE

Opinion

We have audited the accompanying financial statements of **"Centre for Nano and Soft Matter Sciences"** Prof. U.R Rao Road, Jalahalli, Bangalore 560013, which comprises the Balance Sheet as at 31st March 2019, the Statement of Income & Expenditure for year then ended and a summary of significant accounting policies and other explanatory information.

In our opinion and to the best of our information and according to the explanations given to us, the aforesaid financial statements give the information required and give a true and fair view in conformity with the accounting principles generally accepted in India:

1) In the case of Balance Sheet, of the state of affairs of the **"Centre for Nano and Soft Matter Sciences"** , as at 31st March 2019.

2) In case of Income and Expenditure Account, of **DEFICIT,** being **Excess of Expenditure over Income** for the year ended on that date.

Basis for Opinion

We conducted our audit in accordance with the Standards on Auditing (SAs) issued by Institute of Chartered Accountants of India. Our responsibilities under those Standards are further described in the Auditor's Responsibilities for the Audit of the Financial Statements section of our report. We are Independent of the Centre in accordance with the Code of Ethics issued by the Institute of Chartered Accountants of India, and we have fulfilled our other ethical responsibilities in accordance with these requirements and the Code of Ethics. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Management's Responsibility for the Financial Statements

Management is responsible for the preparation of the financial statements. This responsibility also includes maintenance of adequate accounting records for safeguarding of the assets of the Centre and for preventing and detecting frauds and other irregularities; selection and application of appropriate implementation and maintenance of accounting policies; making judgments and estimates that are reasonable and prudent; and design, implementation and maintenance of adequate internal financial controls, that were operating effectively for ensuring the accuracy and completeness of the accounting records, relevant to the preparation and presentation of the financial statement that give a true and fair view and are free from material misstatement, whether due to fraud or error.

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Basavanagudi, Bangalore - 560 004
Phone: 080 - 26566448, 26577448

TeleFax: 080 - 26566337
E-mail: audit@brvgoud.co.in
Website: www.brvgoud.co.in

Auditor's Responsibility for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether the financial statements are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance but is not a guarantee that an audit conducted in accordance with SAs will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

We further report that:

a) We have sought and obtained all the information and explanations which, to the best of our knowledge and belief, were necessary for the purpose of our audit and have found them to be satisfactory.

b) In our opinion, proper books of account as required by law have been kept by the Centre, so far as appears from our examination of those books.

c) The Balance Sheet and Income and Expenditure Account dealt with by this report, are in agreement with the books of accounts.

for B.R.V. GOUD & CO.,
Chartered Accountants
FRN: 000992S

B.R.V. GOUD & CO. CHARTERED ACCOUNTANTS B'LORE-4

(A B Shiva Subramanyam)
Partner
Membership No: 201108

Place: Bangalore
Date: 06-08-2019

UDIN : 19201108AAAACN4860

CENTRE FOR NANO AND SOFT MATTER SCIENCES
JALAHALLI, BENGALURU - 560 013

BALANCE SHEET AS AT 31ST MARCH, 2019

(Amount in Rs.)

I. CORPUS / CAPITAL FUND AND LIABILITIES	SCH	31.03.2019	31.03.2018
CORPUS / CAPITAL FUND	1	25,25,59,623	25,92,58,834
RESERVES AND SURPLUS	2	-	-
EARMARKED PROJECTS FUNDS	3	15,56,87,203	16,62,94,624
SECURED LOANS AND BORROWINGS	4	-	-
UNSECURED LOANS AND BORROWINGS	5	-	-
DEFERRED CREDIT LIABILITIES	6	-	-
CURRENT LIABILITIES AND PROVISIONS	7	2,25,97,863	2,44,42,943
TOTAL		**43,08,44,689**	**44,99,96,401**
II. APPLICATION OF FUNDS/ASSETS			
FIXED ASSETS	8	28,79,45,401	18,74,67,242
INVESTMENTS - FROM EARMARKED/ENDOWMENT FUNDS	9	-	-
INVESTMENTS - OTHERS	10	-	-
CURRENT ASSETS, LOANS, ADVANCES ETC.,	11	14,28,99,288	26,25,29,159
TOTAL		**43,08,44,689**	**44,99,96,401**
SIGNIFICANT ACCOUNTING POLICIES AND NOTES ON ACCOUNTS	24		

(SUBHOD M GULVADY)
ADMINISTRATION & FINANCE OFFICER

(PROF. G.U. KULKARNI)
DIRECTOR

As per our report of even date,
for B.R.V. GOUD & CO.
Chartered Accountants

(A B SHIVA SUBRAMANYAM)
PARTNER
M. NO. 201108

PLACE : BENGALURU
DATE : 06/08/2019

CENTRE FOR NANO AND SOFT MATTER SCIENCES
JALAHALLI, BENGALURU - 560 013

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2019

(Amount in Rs.)

A - INCOME	SCH	2018-19	2017-18
Income from Sales / Services	12	-	-
Grants / Subsidies:	13	8,26,42,000	8,61,99,000
Fees / Subscriptions	14	-	-
Income from Investments(income on investments from earmarked / endowment Funds)	15	-	-
Income from Royalty, Publications etc.,	16	-	-
Interest earned	17	40,41,175	72,57,149
Other Income	18	52,43,581	74,60,981
Increase / (decrease) in stock of finished goods and work-in-progress	19	-	-
TOTAL (A)		**9,19,26,756**	**10,09,17,130**
B - EXPENDITURE			
Establishment Expenses	20	5,73,19,818	4,37,84,317
Other Administrative Expenses etc.,	21	4,35,20,126	4,87,86,654
Expenditures on Grants, Subsidies etc.,	22	-	-
Interest	23	-	-
TOTAL (B)		**10,08,39,944**	**9,25,70,971**
C - BALANCE BEING SURPLUS / (DEFICIT) (A-B)		(89,13,188)	83,46,159
D - Depreciation for the year		(2,06,59,023)	(2,10,26,130)
Prior period adjustment		-	(4,92,389)
E. SURPLUS / (DEFICIT) CARRIED TO CORPUS / CAPITAL FUND (C-D)		(2,95,72,211)	(1,31,72,360)
SIGNIFICANT ACCOUNTING POLICIES AND NOTES ON ACCOUNTS	24		

(SUBHOD M GULVADY)
ADMINISTRATION & FINANCE OFFICER

(PROF. G.U. KULKARNI)
DIRECTOR

PLACE : BENGALURU
DATE : 06/08/2019

As per our report of even date,
for B.R.V. GOUD & CO.,
Chartered Accountants

(A B SHIVA SUBRAMANYAM)
PARTNER
M. NO. 201108

CENTRE FOR NANO AND SOFT MATTER SCIENCES
JALAHALLI, BENGALURU - 560 013

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2019

(Amount in Rs.)

Particulars	As at 31.03.2019	As at 31.03.2018
SCHEDULE 1		
A. CAPITAL FUND:		
As Per Previous Balance Sheet	25,92,58,834	25,07,67,194
ADD: Capital Grants received:		
Campus Development	1,94,00,000	-
Capital Assets	34,73,000	2,16,64,000
	28,21,31,834	27,24,31,194
ADD/(LESS): Surplus / (Deficit) for the year	(2,95,72,211)	(1,31,72,360)
TOTAL	**25,25,59,623**	**25,92,58,834**
SCHEDULE 2 - RESERVES AND SURPLUS:	-	-
SCHEDULE 3 - EARMARKED / PROJECT FUNDS:	**15,56,87,203**	**16,62,94,624**
(See Annexure A for details)		
SCHEDULE 4 - SECURED LOANS AND BORROWINGS:	-	-
SCHEDULE 5 - UNSECURED LOANS AND BORROWINGS:	-	-
SCHEDULE 6 - DEFERRED CREDIT LIABILITIES:	-	-
SCHEDULE 7-CURRENT LIABILITIES & PROVISIONS:		
A) CURRENT LIABILITES:		
1) Statutory Liabilities	35,39,333	11,38,049
2) Other Liabilities	65,11,932	33,54,283
TOTAL (A)	**1,00,51,265**	**44,92,332**
B) **PROVISIONS:**		
Salaries and Services and Supplies	1,25,46,598	1,99,50,611
TOTAL (B)	**1,25,46,598**	**1,99,50,611**
TOTAL (A+B)	**2,25,97,863**	**2,44,42,943**
SCHEDULE 8 - FIXED ASSETS	**28,79,45,401**	**18,74,67,242**
SCHEDULE 9- INVESTMENTS FROM EARMARKED / ENDOWMENT FUNDS:	-	-
SCHEDULE 10 - INVESTMENTS - OTHERS:	-	-
SCHEDULE 11 - CURRENT ASSETS,LOANS, ADVANCES:		
A) CURRENT ASSETS:		
1) Inventories	-	-
2) Sundry Debtors:	-	-
3) Cash Balances in Hand	34,315	-
4) Bank Balances:- Nationalised Banks		
a. Term Deposit Receipts (includes margin money)	5,14,80,477	10,82,07,354
c. Savings Accounts:		
SBI SB A/c No.274	29,63,595	5,27,38,846
SBI SB Project A/c 219	6,34,57,046	8,97,40,438
SBI SB A/c 24430	56,93,967	1,07,890
SBI SB A/c 75676	34,81,683	37,43,762
TOTAL (A)	**12,71,11,083**	**25,45,38,290**

B.R.V. GOUD & CO. CHARTERED ACCOUNTANTS B'LORE-4

Particulars	As at 31.03.2018	As at 31.03.2018
B) LOANS,ADVANCES AND OTHER ASSETS:		
1) Loans	-	-
2) Advances and Other amounts recoverable in Cash		
or in kind or for value to be received:	81,93,764	16,22,444
K P T C L Deposit (SERC/CLCR)	10,22,510	3,62,590
Deposit with BSNL	87,000	87,000
3) Deposits HMT Ltd. and Mohan Gas	3,82,690	3,82,690
4) Grant in Aid Receivable		
5) Accrued Interest & Prepaid Exp.(Insurance)	49,96,451	49,63,300
6) TDS By Bank/ BESCOM & Others	11,05,790	5,72,845
TOTAL (B)	**1,57,88,205**	**79,90,869**
TOTAL (A+B)	**14,28,99,288**	**26,25,29,159**
SCHEDULE 12 - INCOME FROM SALES / SERVICES:	-	-
SCHEDULE 13 - GRANTS / SUBSIDIES:		
Grant in Aid -Salaries	6,13,87,000	4,83,44,000
Grant in Aid -General	2,12,55,000	3,23,55,000
Grant in Aid -Other	-	55,00,000
TOTAL	**8,26,42,000**	**8,61,99,000**
SCHEDULE 14 - FEES / SUBSCRIPTIONS:	-	-
SCHEDULE 15 - INCOME FROM INVESTMENTS:	-	-
SCHEDULE 16 - INCOME FROM ROYALTY, PUBLICATIONS ETC.:	-	-
SCHEDULE 17 - INTEREST EARNED/Accrued:		
1) On Term Deposits - Nationalised Banks	35,12,749	47,75,412
2) On Savings Accounts - Nationalised Bank	5,28,426	24,81,737
TOTAL	**40,41,175**	**72,57,149**
SCHEDULE 18 - OTHER INCOME:		
Sample charges	5,50,480	6,81,800
Miscellaneous Income	18,05,101	10,14,606
Project Administration	-	8,30,000
Conferences and workshops	28,88,000	49,34,575
TOTAL	**52,43,581**	**74,60,981**
SCHEDULE 19 - INCREASE (DECREASE) IN STOCK OF FINISHED GOODS & WORK IN PROGRESS:	-	-
SCHEDULE 20 - ESTABLISHMENT EXPENSES:		
1) Salaries, Allowance and Wages to Staff	5,68,91,429	3,53,61,237
2) Medical Expenses Reimbursed	34,131	36,204
3) Fellowship & Book Grant	-	83,86,876
4) Welfare Expenses	3,94,258	4,89,742
TOTAL	**5,73,19,818**	**4,37,84,317**

B.R.V. GOUD & CO. CHARTERED ACCOUNTANTS B'LORE-4

Particulars	As at 31.03.2019	As at 31.03.2018
SCHEDULE 21 - OTHER ADMINISTRATIVE EXPENSES,ETC:		
Auditors Remuneration	41,300	41,300
Chemicals, Glasswares & Consumables etc.,	18,22,982	20,55,701
Duties & Taxes	37,263	3,49,927
Electricity & Water Charges	37,95,331	32,84,237
Fees & Professional charges	8,59,345	8,12,070
Fuel Charges for Genset	2,63,205	1,78,938
Hospitality Charges	-	3,17,655
House Keeping Charges	55,32,003	26,27,263
Journals & Periodicals /Books	1,31,801	5,19,596
Reimbursement of Fees to Students	4,14,335	1,34,802
Conveyance/ Transportation Charges	27,59,074	19,80,058
Man Power Supply Expenses	83,11,604	53,04,307
Other Miscellaneous Charges / Bank Charges	6,66,258	1,36,276
Advertisement and Publicity Charges	52,107	1,48,106
Printing & Stationery	6,10,647	7,87,121
Registration & Renewals	55,200	2,46,725
Rent & Insurance	53,57,148	47,05,262
Repairs & Maintenance	33,30,774	57,60,390
Security Charges	42,49,128	32,36,077
Seminars and Conferences	32,58,876	1,23,28,117
Telephone & Postage	5,94,764	7,76,651
Travel Expenses	11,77,386	14,64,006
Testing (N.M.R.) & Sample analysis charges	58,395	17,461
IPR Related Expenses	1,41,200	7,44,608
Project Administration	-	8,30,000
TOTAL	**4,35,20,126**	**4,87,86,654**
SCHEDULE 22 - EXPENDITURE ON GRANTS, SUBSIDIES ETC:	-	-
SCHEDULE 23 - INTEREST:	-	-

B. PROJECTS

(Amount in Rs.)

DESCRIPTION	W.D.V. as on 01.04.2018	Additions during the year			Total as on 31.03.2019	Rate of Dep.	Depreciation Full Rate	Dep. For Addition <180 Days	Total Depreciation for the year	W.D.V. as on 31.03.2019
		>180 days	<180 Days	Total additions						
I. Assets Under Closed Projects	52,69,314			-	52,69,314	15	7,90,397	-	7,90,397	44,78,917
II. DST/TPF/ GUK / 05/16-19										
Equipment	2,01,279	4,78,84,960	1,39,90,634	6,18,75,594	6,20,76,873	15	72,12,936	10,49,298	82,62,234	5,38,14,639
II. IGSTC/GUK/03/16-19										
Equipment	20,810			-	20,810	15	3,122	-	3,122	17,688
III. DST/NMNT/GUK/06/2017-19										
Equipment (WIP)	1,08,16,599	82,47,039	55,64,072	1,38,11,111	2,46,27,710	15	28,59,546	-	28,59,546	2,17,68,164
IV. SERB/EMA/SANG/01/2017-20										
Equipment	3,60,223			-	3,60,223	15	54,033	-	54,033	3,06,190
V. SERB/EMR/CVY/01/2017-20										
Equipment	18,30,148			-	18,30,148	15	2,74,522	-	2,74,522	15,55,626
VI. TSAMRC										
Equipment	76,86,162	5,33,373		5,33,373	82,19,535	15	12,32,930	-	12,32,930	69,86,605
VI. HPCL/IIT/NSJ/01/17-18										
Equipment	-	6,21,008	-	6,21,008	6,21,008	15	93,151	-	93,151	5,27,857
Total (B)	**2,61,84,535**	**5,72,86,380**	**1,95,54,706**	**7,68,41,086**	**10,30,25,621**		**1,25,20,637**	**10,49,298**	**1,35,69,935**	**8,94,55,686**
Grand Total (A+B)	**18,74,67,242**	**8,78,42,413**	**4,68,64,704**	**13,47,07,117**	**32,21,74,359**		**3,22,67,004**	**19,61,954**	**3,42,28,958**	**28,79,45,401**
Previous Year Grand Total (A+B)	***14,00,81,780***	***1,56,66,991***	***5,49,41,478***	***7,06,08,469***	***21,06,90,249***		***2,18,42,172***	***13,80,835***	***2,32,23,007***	***18,74,67,242***

PLACE: BANGALORE
DATE : 06/08/2019

(SUBHOD M GULVADY)
ADMINISTRATION & FINANCE OFFICER

(PROF. G.U. KULKARNI)
DIRECTOR

As per our report of even date,
for B.R.V. GOUD & CO.
Chartered Accountants,

(A B SHIVA SUBRAMANYAM)
PARTNER
M. NO. 201108

Annexure - A to Schedule 3

(Amount in Rs.)

Industries Sponsor Project/ Joint Venture with Industries				Total of Projects			
FUNDS	**TSAMRC**	**Tata Steel**	**HPCL/IIT/NS J/01/17-18**	**Total of Industry projects (A)**	**Total of Govt. Projects (B)**	**Total of (A+B)**	**Previous Year**
a) Opening Balance of the Funds	1,01,73,227	11,36,602	(1,47,964)	1,11,61,865	15,51,32,759	16,62,94,624	5,10,22,130
b) Additions to the Funds:							
i) Grants	97,45,000	-	25,96,510	1,23,41,510	64,21,360	1,87,62,870	12,84,82,826
ii) Income from investment made	4,34,714	29,425	18,551	4,82,690	58,38,469	63,21,159	45,37,202
iii) Other Receipts				-	3,91,866	3,91,866	
iii) Trfrd. during the year				-	-		
TOTAL (a+b)	**2,03,52,941**	**11,66,027**	**24,67,097**	**2,39,86,065**	**16,77,84,454**	**19,17,70,519**	**18,40,42,158**
c) Utilisation/Expenditure towards objectives of Funds:							
Rental and Maintenance Charges	9,42,818	-	-	9,42,818	-	9,42,818	10,83,506
Project Cost	29,32,915	-	-	29,32,915	-	29,32,915	37,42,819
Other Expenditure as per project	-	9,95,276	2,135	9,97,411	-	9,97,411	7,85,786
Salaries, Wages and	-	-	8,08,800	8,08,800	73,41,954	81,50,754	50,66,763
Allowances etc.,	-	-	-	-	-	-	
Consumables/ travel	-	-	2,20,048	2,20,048	37,68,634	39,88,682	46,55,719
	-	-	-	-	14,08,974	14,08,974	
Depreciation	12,32,930	-	93,151	13,26,081	1,22,43,854	1,35,69,935	21,96,877
Overheads	-	-	2,00,000	2,00,000	7,75,045	9,75,045	2,16,064
Grant Refunded	-	-	-	-	31,16,782	31,16,782	-
TOTAL (c)	**51,08,663**	**9,95,276**	**13,24,134**	**74,28,073**	**2,86,55,243**	**3,60,83,316**	**1,77,47,534**
NET BALANCE AT THE YEAR END (a+b-c)	**1,52,44,278**	**1,70,751**	**11,42,963**	**1,65,57,992**	**13,91,29,211**	**15,56,87,203**	**16,62,94,624**

B.R.V. DESAI & CO. CHARTERED ACCOUNTANTS B'LORE-4

CENTRE FOR NANO AND SOFT MATTER SCIENCES
JALAHALLI, BANGALORE - 560 013
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2018

SCHEDULE - 8 : FIXED ASSETS

A. CENS :

(Amount in Rs.)

DESCRIPTION	W.D.V. as on 01.04.2018	Additions during the year			Total as on 31.03.2019	Rate of Dep.	Depreciation Full Rate	Dep. For Addition <180 Days	Total Depreciation for the year	W.D.V. as on 31.03.2019
		>180 days	<180 Days	Total additions						
CIVIL WORKS										
Aluminium Partitions	16,76,842			-	16,76,842	10	1,67,684	-	1,67,684	15,09,158
Brick Base(Partitions)	72,417			-	72,417	10	7,242	-	7,242	65,175
Construction of Cycle Stand	28,572			-	28,572	10	2,857	-	2,857	25,715
Construction of Shed	29,445			-	29,445	10	2,945	-	2,945	26,500
Vinyl Flooring	1,40,915			-	1,40,915	10	14,092	-	14,092	1,26,823
Other Miscellaneous Works	22,47,731			-	22,47,731	10	2,24,773	-	2,24,773	20,22,958
New Campus (WIP)	1,61,87,825	2,75,80,343	65,12,267	3,40,92,610	5,02,80,435	-	-	-	-	5,02,80,435
Infrastructure	1,98,81,776		86,28,985	86,28,985	2,85,10,761	-	-	-	-	2,85,10,761
BUILDING (Main & Annexe)	50,19,009			-	50,19,009	10	5,01,901	-	5,01,901	45,17,108
ELECTRICAL INSTALLATIONS										
Air Conditioner	8,99,764			-	8,99,764	15	1,34,965	-	1,34,965	7,64,799
Computers	10,17,086	20,06,415		20,06,415	30,23,501	60	18,14,101	-	18,14,101	12,09,400
Fume Cupboard	96,762			-	96,762	10	9,676	-	9,676	87,086
Electrical Installation	12,70,507	6,05,559		6,05,559	18,76,066	10	1,87,607	-	1,87,607	16,88,459
Generator Set	2,69,344			-	2,69,344	15	40,402	-	40,402	2,28,942
FURNITURE & FIXTURES										
Carpentry Works	3,26,180			-	3,26,180	10	32,618	-	32,618	2,93,562
Furniture & Fixtures	51,16,608	2,20,070		2,20,070	53,36,678	10	5,33,668	-	5,33,668	48,03,010
GENERAL EQUIPMENTS					-					
Canteen Vessels and Equipments	1,86,065	28,493		28,493	2,14,558	15	32,184	-	32,184	1,82,374
Equipment	72,11,798	3,27,805	1,21,68,746	1,24,96,551	1,97,08,349	15	11,30,940	9,12,656	20,43,596	1,76,64,753
Workshop & Other Equipments	1,38,091			-	1,38,091	15	20,714	-	20,714	1,17,377
SCIENTIFIC EQUIPMENTS	9,94,65,970	(2,12,652)		(2,12,652)	9,92,53,318	15	1,48,87,998	-	1,48,87,998	8,43,65,320
Total - (A)	**16,12,82,707**	**3,05,56,033**	**2,73,09,998**	**5,78,66,031**	**21,91,48,738**		**1,97,46,367**	**9,12,656**	**2,06,59,023**	**19,84,89,715**

B.R.V. GOUD & CO. CHARTERED ACCOUNTANTS B'LORE-A

Centre for Nano and Soft Matter Sciences

B. PROJECTS

(Amount in Rs.)

DESCRIPTION	W.D.V. as on 01.04.2018	Additions during the year			Total as on 31.03.2019	Rate of Dep.	Depreciation Full Rate	Dep. For Addition <180 Days	Total Depreciation for the year	W.D.V. as on 31.03.2019
		>180 days	<180 Days	Total additions						
I. Assets Under Closed Projects	52,69,314			-	52,69,314	15	7,90,397	-	7,90,397	44,78,917
II. DST/TPF/ GUK / 05/16-19										
Equipment	2,01,279	4,78,84,960	1,39,90,634	6,18,75,594	6,20,76,873	15	72,12,936	10,49,298	82,62,234	5,38,14,639
II. IGSTC/GUK/03/16-19										
Equipment	20,810			-	20,810	15	3,122	-	3,122	17,688
III. DST/NMNT/GUK/06/2017-19										
Equipment (WIP)	1,08,16,599	82,47,039	55,64,072	1,38,11,111	2,46,27,710	15	28,59,546	-	28,59,546	2,17,68,164
IV. SERB/EMA/SANG/01/2017-20										
Equipment	3,60,223			-	3,60,223	15	54,033	-	54,033	3,06,190
V. SERB/EMR/CVY/01/2017-20										
Equipment	18,30,148			-	18,30,148	15	2,74,522	-	2,74,522	15,55,626
VI. TSAMRC										
Equipment	76,86,162	5,33,373		5,33,373	82,19,535	15	12,32,930	-	12,32,930	69,86,605
VI. HPCL/IIT/NSJ/01/17-18										
Equipment	-	6,21,008	-	6,21,008	6,21,008	15	93,151	-	93,151	5,27,857
Total (B)	**2,61,84,535**	**5,72,86,380**	**1,95,54,706**	**7,68,41,086**	**10,30,25,621**		**1,25,20,637**	**10,49,298**	**1,35,69,935**	**8,94,55,686**
Grand Total (A+B)	**18,74,67,242**	**8,78,42,413**	**4,68,64,704**	**13,47,07,117**	**32,21,74,359**		**3,22,67,004**	**19,61,954**	**3,42,28,958**	**28,79,45,401**
Previous Year Grand Total (A+B)	***14,00,81,780***	***1,56,66,991***	***5,49,41,478***	***7,06,08,469***	***21,06,90,249***		***2,18,42,172***	***13,80,835***	***2,32,23,007***	***18,74,67,242***

PLACE: BANGALORE
DATE : 06/08/2019

(SUBHOD M GULVADY)
ADMINISTRATION & FINANCE OFFICER

(PROF. G.U. KULKARNI)
DIRECTOR

As per our report of even date,
for B.R.V. GOUD & CO.
Chartered Accountants,

(A B SHIVA SUBRAMANYAM)
PARTNER
M. NO. 201108

CENTRE FOR NANO AND SOFT MATTER SCIENCES, JALAHALLI, BENGALURU

SCHEDULES FORMING PART OF THE ACCOUNTS FOR THE YEAR ENDED 31ST MARCH 2019

SCHEDULE 24: SIGNIFICANT ACCOUNTING POLICIES AND NOTES ON ACCOUNTS

OVERVIEW:

Centre for Nano and Soft Matter Sciences is registered as a society under the Karnataka Societies Registration Act, 1960 and also registered under Section 12A of the Income Tax Act, 1961. It is an autonomous institution recognised and substantially funded by the Department of Science and Technology, Government of India.

The main objects of the Centre, inter-alia, are to conduct basic and applied research in Nano and Soft Matter Sciences and specifically focused on a variety of metal and semi-conductor nanostructures, liquid crystals, gels, membranes and hybrid materials.

A. SIGNIFICANT ACCOUNTING POLICIES:

1. **Accounting Conventions**: The financial statements are drawn up in accordance with historical accounting conventions and on the going concern concept. Accrual method of accounting is followed to record Income and Expenditure.

   The guidelines as per the Uniform Format of Accounts for Central Autonomous Institutions, as applicable and to the extent practicable, are followed in the presentation of the financial statements of the Centre.

   The Centre has adopted a new Fund based Management and Accounting System namely SFACTS since 1st of October 2018. The balances up to 30th September 2018 were migrated from Tally ERP system to the new software after proper verification and the statement of accounts finalized through SFACTS.

2. **Investments**: Investments are stated at cost and Interest from Investments are accounted on accrual basis.

3. **Fixed Assets:** Fixed assets are stated at written down value. Fixed assets are accounted at cost of acquisition, inclusive of inward freight, duties, taxes and incidental expenses related to acquisition.

   All Capital Expenditure incurred during the year for acquisition of Fixed Assets is shown under the respective heads of Fixed Assets and depreciation thereof is charged to Income and Expenditure account as against the earlier method of showing the whole of capital expenditure as a charge to Income and Expenditure account.

4. **Depreciation**: Depreciation on Fixed assets has been provided on Written Down Value Method at rates as per Income Tax Rules, 1962.

5. **Government Grants / Other Grants**: The Grants received are recognized in the accounts on accrual basis. Capital grants received for procurement of Fixed Assets is credited to the capital fund account.

6. **Retirement Benefits:**
   No provision has been made in respect of the Leave Encashment and Gratuity liability in the accounts as required by AS 15. However, the same is accounted on cash basis as and when the liability is discharged.

7. **Allocation / Transfer to Earmarked Project Funds:** The Centre has a policy to transfer interest earned on investments relating to project funds, to earmarked project funds, to recognise the interest attributable to those funds. To meet exigencies in project related expenditure, a fund called Project Administration is maintained under project accounts and allocation of funds to any project is made out of the said fund.

B. NOTES ON ACCOUNTS:

1. Claims against the Centre not acknowledged as debts Rs. Nil (Previous year Rs. Nil).

2. Foreign currency transactions are translated at the rates prevailing on the date of transaction. During financial year 2018-19 Rs. 67283525/- was paid in foreign currency for purchase of scientific equipment and other expenditure as compared to financial year 2017-18 of Rs. 1,18,33,125/-

3. Depreciation on fixed assets acquired out of Grant-in-aid amounting to Rs. 20659023/- is debited to Income and Expenditure account. Depreciation on fixed assets acquired out of project funds amounting to Rs. 13569935/-is debited to respective earmarked fund account.

4. **Income Tax:** The Centre is registered under Section 12A of the Income Tax Act, 1961 and is eligible for exemption from tax and hence no provision has been made towards Income Tax.

5. Figures are rounded off to the nearest rupee and figures of previous year have been regrouped and reclassified to conform to that of the current year.

6. Schedules 1 to 23 are annexed to and form an integral part of the Balance Sheet as at 31st March 2019 and the Income and Expenditure Account for the year ended on that date.

(SUBHOD M GULVADY)
ADMINISTRATION &
FINANCE OFFICER

(PROF. G.U. KULKARNI)
DIRECTOR

As per our report of even date
For B.R.V. Goud & Co.
Chartered Accountants

(A.B. SHIVA SUBRAMANYAM)
PARTNER

19. MISCELLANEOUS

19.1. IN-HOUSE COLLOQUIA / SEMINARS

19.1.1 Ph.D. Students

Thematic

Title of Colloquia/Seminar	Speaker	Date
Breath analysis: a non-invasive way of disease diagnosis	Sachin Ashok Bhat	08.02.2019
Greenhouse gases: Implication, detection and possible remedies	RajashekharPujar	28.03.2019

Journal Article based Seminar

Title of Colloquia/Seminar	Speaker	Date
3D printing PDMS elastomer in a hydrophilic support bath via freeform reversible embedding	Pragnya Satapathy	25.05.2018
Making waves in a photoactive polymer film	Varshini G. V.	31.05.2018
MXene molecular sieving membranes for highly efficient gas separation	Ramya Prabhu B.	08.06.2018
An artificial flexible visual memory system based on an UV-motivated memrister	Gaurav Shukla	26.06.2018
New insights into the electro-chemical hydrogen oxidation and evolution reaction mechanism	Alex C.	28.06.2018
Porous organic/inorganic hybrid one dimensional photonic crystals for rapid visual detection of organic solvents	Madhu BabuKanakala	02.07.2018
Fractal design concepts for stretchable electronics	Prashanth Nayak	04.07.2018
Wavelength-tuneable lasing from stretchable chiral nematic liquid crystals	Marlin Baral	05.07.2018
A multi-state memory device based on the unidirectional spin hall magnetoresistance	Subir Roy	10.07.2018
Photochemically and thermally driven color reflection in a halogen-bonded chiral molecular switch	Rekha S. Hegde	13.07.2018
Humidity-tolerant single stranded DNA-functionalized graphene probe for medical applications of exhaled breath analysis	Suman Kundu	20.07.2018
High-performance hazy silver nanowire transparent electrodes through diameter tailoring for semitransparentphotovoltaics	Indrajit Mondal	27.07.2018
Scanning plasmonic color display	Brindhu Malani S	30.11.2018
From windows to solar cell and vice versa	Anamul Haque	14.12.2018

Thesis Colloquia

Title of Colloquia/Seminar	Speaker	Date
Thin films of ferroelectric polymer, blends and composites at interfaces	Chandan Kumar	25.01.2018
Studies on the surface properties of Langmuir-Blodgett films of some biological and mesogenic molecules	Arup Sarkar	03.05.2018
Synthesis and Characterization of Liquid Crystalline Compounds	Veerabhadraswamy B. N.	27.06.2018
A study on structure-property relationship of some thermotropic liquid crystalline materials	Monika M	29.06.2018
Preparation and electronic properties of thin films of electro-active organic molecules	Priya Madhuri K.	28.09.2018

19.1.2 Visitors

Title of Colloquia/Seminar	Speaker	Date
Optical Simulation with CST	Mr. Pankaj Jha	10.07.2018
Modelling high frequency electromagnetics using COMSOl multiphysics	Ms. Manisha Chetry	16.07.2018
Intellectual property services with emphasis onpatent filing	Mr. Prayank Khandelwal Legasis Services & Mr.Raghavendra Bhat Legasis Services	17.07.2018
An introduction to Kelvin probe for surface work function measurements – a non-contact surface analytical tool	Prof. A. Subrahmanyam IIT-Madras	31.08.2018
Introduction and range of mask aligner and nano imprint lithography for modern research	Mr. Peter Lee, Director MIDAS Systems Company Ltd, South Korea	17.09.2018
Order–disorder transitions in molecular solids	Prof. Michael L. Klein, FRS, Temple University, USA	08.10.2018
Ion transport mechanisms in electrolytes and modeling advanced strategic materials	Dr. Santosh Mogurampelly, Temple University, USA	12.10.2018
Nanoscale materials by atomic and molecular deposition	Prof. Stacey F. Bent, Stanford University, USA	19.12.2018
Addressing physicochemical features in molecular crystals via chemical and quantum crystallographical methods	Dr. Rumpa Pal University of Tsukuba, Japan	07.02.2019
How the trap states affect charge carrier dynamics of semiconductor quantum dots	Prof. K. George Thomas IISER-TVM, Thiruvananthapuram	29.04.2019
Hybrid nanomaterials for photon harvesting	Prof. Amitava Patra, Indian Association for the Cultivation of Science, Kolkata	27.05.2019

19.2 FACULTY VISITS INDIA/ABROAD

Prof. G.U. Kulkarni

Place and period of visit	Purpose of visit	Title of talk
PapierfabrikLouisenthal GmbH, Germany 12-13 April 2018	3rd workshop of IGSTC project METNETWORK	Project interaction
DESY, Germany 20-28 June 2018	German Electron synchrotron	Collaborative research work
International Iberian nanotechnology laboratory, Portugal 15-18 October 2018	India-Portugal Workshop on Nanotechnology	Metal nanomesh based transparent conductors for optoelectronic devices

Dr. S. Krishna Prasad

Place and period of visit	Purpose of visit	Title of talk
University of Allahabad, Allahabad 19-21 December 2018	25th National Conference on Liquid Crystals	Invited Lecture

Dr. Geetha G. Nair

Place and period of visit	Purpose of visit	Title of talk
IIT Madras 13 December 2018	Collaborative project	Bilateral discussion

Place and period of visit	Purpose of visit	Title of talk
IIT Madras Incubation Cell (IITMIC) 12 December 2018	To discuss about the modalities of Technology Business Incubator with IITMIC management team	Discussion

Dr. D.S.Shankar Rao

Place and period of visit	Purpose of visit	Title of talk
University of Allahabad, Allahabad 19-21 December 2018	25thNational Conference on Liquid Crystals	Invited talk: Nanophase segregation of nanostructures: induction of smecticAand re-entrance in a carbon nanotube/nematic liquid crystal composite

Dr. C.V.Yelamaggad

Place and period of visit	Purpose of visit	Title of talk
S. E. A. College of Engineering and Technology, Bangalore 07 April 2018	One day symposium on "Application of advanced nanomaterials", organized by Department of Basic Science.	Invited talk: Nanomaterials and their applications
Christ University, Bangalore 22 May 2018	Quality Improvement Program of Christ University, Bangalore	Invited lecture: Liquid crystals Fundamental science and technology
Department of Chemistry, Ramaiah Institute of Technology, Bangalore 23 July 2018	Faculty Development Program on Functional Materials for Industrial Applications (FMIA-2018)	Invited lecture: Industrial implications of liquid crystals
Christ University, Banaglore 31 August 2018	One day symposium on "Emerging trends in Chemical Sciences"	How crystals can be liquids?
Vijaya College, Bangalore 8 September 2018	One day symposium "Nanoscience – Present and Future Potential"	Invited lecture: Soft-Nano: Science and technology
Vijaya College, Bangalore 8 September 2018	One day symposium "Nanoscience – Present and Future Potential"	Invited lecture: Fluid birefringent gold nanoparticles
Tumkur University, Tumkur 20 November 2018	Under Bangalore India Nano 2018 program a talk was presented at the Tumkur University to high school students	Nanomaterials; Invisibility
Gulbarga University, Gulbarga 23 November 2018	Under Bangalore India Nano 2018 program a talk was presented at the Gulbarga University to high school students	Nanomaterials; Invisibility
Sree Siddaganga College of Arts, Science and Commerce Tumkur 1 December 2018	INSPIRE program organized by Sree Siddaganga College of Arts, Science and Commerce Tumkur,	Nanomaterials; Invisibility
University of Allahabad, Allahabad 19 December 2018	25thNational Conference on Liquid Crystals	Tris(boranil), n-type columnar liquid crystals –The first examples
Indian Academy Degree College, Bangalore 12 January 2019	INSPIRE program organized by Indian Academy Degree College, Bangalore	Functional shape-anisotropic organic molecules: Life, science and technology
Maharani Lakshmi Ammanni College for Women, Bangalore 12 February 2019	National Conference on "Smart Synergy"- Emerging Trends in Application of Smart Materials	Invited lecture:Smartmaterials for science & technology of invisibility
Indian Institute of Science, Bangalore 15 February 2019	First Indian materials Conclave and 30th AGM of MRSI held at JN Tata Auditorium, Indian Institute of Science, Bangalore.	MRSI Medal Lecture:pseudo-triphenylene boron(III) complexes with $N_3B_3O_3$ Core: tris(boranil), n- and p-type columnar liquid crystals

Place and period of visit	Purpose of visit	Title of talk
Jindal First Grade College For Women, Jindal Nagar, Bangalore 15 February 2019	One one-day symposium on materials organized by the Department of Chemistry, Jindal First Grade College For Women, Jindal Nagar, Bangalore.	Invited lecture: Liquid crystals: Life, science and technology
Indian Academy Degree College, Bangalore 12 January 2019	INSPIRE program organized by Indian Academy Degree College, Bangalore	Functional shape-anisotropic organic molecules: life, science and technology
Central College, Bangalore University, Bangalore 15 March 2019	Two days conference, organized by the Department of chemistry, Central college, Bangalore University, during 14-15 March 2018.	Invited lecture: Inherent self-assembly of homomeric dipeptides into technologically significant ferroelectric columnar liquid crystalline phase
NMKRV college, Bangalore 27March 2019	One day conference "Best Practices in Chemistry"	Invited talk :Liquid crystals: Life, science and technology

Dr. S. Angappane

Place and period of visit	Purpose of visit	Title of talk
Dayananda Sagar College of Engineering, Bangalore 19 June 2018	Faculty Development Program	Nanolithography
Coimbatore 27 June 2018	To conduct PhD viva-voce at Department of Medical Physics, Bharathiar University	
Bharat Electronics Bangalore 6 July 2018	SODET Workshop	Nanostructures for wettability and light trapping applications
San Francisco, USA 16-20 July 2018	International Conference on Magnetism (ICM 2018)	Extraordinary ferromagnetic coupling and magnetodielectric phenomena in NiO nanoparticles
VNIT, Nagpur 18 January 2019	PhD viva-voce at Department of Physics	
RIT, Bangalore 2 February 2019	Faculty Development Program	Nanolithography
Anna University, Tirunelveli 22 March 2019	PhD viva-voce at Department of Physics, University College of Engineering	

Dr. P. Viswanath

Place and period of visit	Purpose of visit	Title of talk
IIT Kanpur 20 – 22, September 2018	OSI – International symposium on Optics	Refractive index sensing using gold nanohole arrays fabricated by colloidal lithography

Dr.Neena S. John

Place and period of visit	Purpose of visit	Title of talk
MG University, Kottayam, Kerala May 11-13, 2018	International conference on Nanomaterials-ICN 2018	Molybdenum oxide nanostructures on rigid substrates
Jain University, Bangalore August 30-31, 2018	National Seminar on Frontier in in Materials and Chemical Sciences	Metal oxide nanostructures and hybrids
Jawaharlal Nehru National College for Engineering, Shivamogga September 7-8, 2018	Indian Academy workshop on 'Emerging Trends in Nanoscience and Nanotechnology'	Synthesis of inorganic nanomaterials

Place and period of visit	Purpose of visit	Title of talk
Higher Education Academy, Karnatak University, Dharwad November 16-17, 2018	Academy workshop on 'Recent Developments in Materials Research'	Microscopy for nanoworld
Indian Institute of Science, Bangalore February 12-15, 2019	First Indian Materials Conclave, MRSI	Molybdenum oxide nanostructures

Dr.Pralay K. Santra

Place and period of visit	Purpose of visit	Title of talk
CNMS, JAIN University, Bengaluru 13- 15 March 2019	Attending Conference	Attempts to develop colorimetric metal ion and gas sensors
CNMS, JAIN University, Bengaluru 30-31 August 2019	Attending Conference	Quantum dot - applications in solar cells to sensors
JNCASR, Bengaluru 17 Jul 2018	Attending Conference	Ineternal heterostructure of pure and anion exchanged CsPbX3 nanocubes
IISER - TVM, Thiruvananthapuram 12-14 July 2018	Attending Conference	Heterostructure of perovskite nanomaterials
Kuvempu University, Shivamogga 9-10 February 2018	Attending Conference	Ineternal heterostructure of pure and anion exchanged CsPbX3 nanocubes

Dr. H.S.S.R. Matte

Place and period of visit	Purpose of visit	Title of talk
Australia	Attending conference	Highly concentrated and stable semiconducting inks in low boiling point solvents for printed electronics - Invited Talk

19.3. ACADEMIC ACTIVITIES OF PH.D. STUDENTS AND RESEARCH ASSOCIATES

Rajashekhar Pujar, SRF

No.	Date(s)	Name of Conference	Presentation Mode & Title
1.	20.02.2019	ChemPhysMat2019	Poster: Stress modulation in desiccating crack networks for producing effective templates for patterning metal network based transparent conductors.

Remya K Govind, RA-II

No.	Date(s)	Name of Conference	Presentation Mode & Title
2.	5-7 Dec. 2018	10th Bengaluru INDIA NANO	Participated
3.	21-23 Mar. 2018	International Conference on Nanoscience and Nanotechnology (ICONSAT-2018)	Poster: Large area fabrication of flexible transparent conducting mesh electrodes by screen printing
4.	21-23 Mar. 2018	International Conference on Nanoscience and Nanotechnology (ICONSAT-2018)	Oral: Affordable smart windows

Ashutosh K. Singh, Scientist-C (Project)

No.	Date(s)	Name of Conference	Presentation Mode & Title
5.	5-8 Oct. 2018	Young Science Conference at India International Science Festival (IISF-2018)	Poster: Affordable smart windows
6.	5-7 Dec. 2018	10th Bengaluru INDIA NANO	Poster: Hybrid transparent conducting glass: A technology project

Suman Kundu, SRF

No.	Date(s)	Name of Conference	Presentation Mode & Title
7.	5 Dec. 2018	10th Bengaluru INDIA NANO	Poster: Planar supercapacitor made of supramolecular nanofibre based solid electrolyte exhibiting 8 V window
8.	13 Mar. 2019	International conferenceonFrontiers in Materials from Basic Science to Real time Applications	Poster: Ultrafast humidity sensing by supramolecular nanofibre for real-time breath and hydration observation using smart-phone or PC

Pragnya Satapathy, SRF

No.	Date(s)	Name of Conference	Presentation Mode & Title
9.	22-24 Oct. 2018	9th MRS Trilateral Conference on Advances in Materials: Energy, Water and Healthcare, CeNS, Bengaluru	Poster: Anisotropic fast electrically switchable emission from composites of CsPbBr3 perovskite quantum cuboids in a nematic liquid crystal
10.	19-21 Dec. 2018	25th National Conference on Liquid Crystals, Prayagraj	Oral: Soft photomechanical actuation in PDMS – porous nanocarbon composites: Fast response for flexible robotic applications
11.	20-22 Feb. 2019	ChemPhysMat 2019, Bengaluru	Poster: Porosity-dependent optical actuation in PDMS/ nano-carbon composites : Fast response & effect of metallic bilayer

Marlin Baral, SRF

No.	Date(s)	Name of Conference	Presentation Mode & Title
12.	5-7 Dec. 2018	10th Bengaluru INDIA NANO	Poster:Switchable fluorescent three-state memory device
13.	9-11 Dec. 2018	IUWSM (Indo US Workshop on Soft Materials), Roorkee	Participated

Sujeet Dutta, NPDF

No.	Date(s)	Name of Conference	Presentation Mode & Title
14.	13-15 Apr. 2018	International Symposium on Functional Materials, Chandigarh (ISFM-2018)	Oral:Nanoconfinement of n-alkanes as a strategy for controlled disorder

No.	Date(s)	Name of Conference	Presentation Mode & Title
15.	22-27 Jul. 2018	27 International Liquid Crystal Conference, Kyoto, Japan (ILCC-2018)	Oral:Employment of POSS-gold nano-particle network for enhancement of electrical conductivity in a nematic liquid crystal

Aswathi B Nair, ROI Student

No.	Date(s)	Name of Conference	Presentation Mode & Title
16.	15-17 Feb. 2019	4th Kerala Technological Congress KETCON 2019	Oral: Facile synthesis of Selenium sub-micron sphere and nanorods

S. Vimala, Research Personnel

No.	Date(s)	Name of Conference	Presentation Mode & Title
17.	4-5 Dec. 2018	Hands on workshop on Material Modelling and Simulation: Molecular Dynamics	Participated

Nurjahan Khatun

No.	Date(s)	Name of Conference	Presentation Mode & Title
18.	5-7 Dec. 2018	10th Bengaluru INDIA NANO	Poster: Liquid Crystal mediated tunability of forward scattering

Sharadhi N Raj

No.	Date(s)	Name of Conference	Presentation Mode & Title
19.	5-7 Dec. 2018	10th Bengaluru INDIA NANO	Poster: Liquid Crystal mediated tunability of forward scattering

Amit Bhardwaj

No.	Date(s)	Name of Conference	Presentation Mode & Title
20.	5-7 Dec. 2018	10th Bengaluru INDIA NANO	Poster: Liquid Crystal mediated tunability of forward scattering

G.V.Varshini, SRF

No.	Date(s)	Name of Conference	Presentation Mode & Title
21.	21-23 Mar. 2018	ICONSAT, Bangalore	Poster: Influence of CNT loading on the elastic constant and phase sequence in liquid crystal+ CNT composites
22.	22-24 Oct. 2018	9th MRS Trilateral Conference, CeNS	Poster: Influence of CNT loading on the elastic constant and phase sequence in liquid crystal+CNT composites
23.	5-7 Dec. 2018	Bengaluru India Nano	Participation

Rajalaxmi Sahoo

No.	Date(s)	Name of Conference	Presentation Mode & Title
24.	21-23 Mar. 2018	ICONSAT, Bangalore	Participation
25.	5-7 Dec. 2018	Bengaluru India Nano	Poster: Giant block Twist Grain Boundary phases: Effect of Nanoparticles
26.	9-21 Dec. 2018	25th NCLC, University of Allahabad	Poster: Giant block Twist Grain Boundary phases: Effect of Nanoparticles
27.	20-22 Feb. 2019	International Conference on “Chemistry and Physics of Materials: Glorious Past and Exciting Future”, held at JNSCAR	Poster: Twist Grain Boundary phases:Effect of Gold nanorods

Sachin Ashok Bhat, SRF

No.	Date(s)	Name of Conference	Presentation Mode & Title
28.	22-24 Oct. 2018	9th MRS Trilateral conference on Advances in NanoMaterials: Energy, Water and Health care	Poster: MOF-Graphene nanohybrids for molecular hydrogen evolution.
29.	5-7 Dec. 2018	10th Bengaluru India Nano-2018	Tata Steel stall (poster): Two Dimensional COPs for Fluorimetric Detection of Explosives
30.	19-21Dec. 2018	25th National Conference on Liquid Crystals	Oral:Photoresponsive Gold Nanoparticles: Synthesis and Characterization of Liquid crystal –Nanoparticle composites

No.	Date(s)	Name of Conference	Presentation Mode & Title
31.	20-22 Feb. 2019	International Conference on Chemistry and Physics of Materials: Glorious Past and Exciting Future-2018	Poster: MOF-Graphene nanohybrids for molecular hydrogen evolution

Madhu Babu Kanakala, SRF

No.	Date(s)	Name of Conference	Presentation Mode & Title
32.	14-15 Mar. 2019	Synthetic and Biological Peptides: Structures and Strategies for the Development of Drugs, Biologics and Materials	Participated
33.	05-07 Dec. 2018	10th Bengaluru India Nano-2018	Poster: Gold nano particles coated with optically active mesogenic ligands: synthesis and characterization
34.	19-21 Dec. 2018	25th National Conference on Liquid Crystals	Poster: Optically active mesomorphic dimmers derived from cholesterol : Synthesis and charecterization
35.	14-15 Mar. 2019	Synthetic and Biological Peptides: Structures and Strategies for the Development of Drugs, Biologics and Materials	Poster: The Self-Assembly of A Homomeric Dipeptide Into Columnar Liquid Crystal Phase

Gaurav Shukla, SRF

No.	Date(s)	Name of Conference	Presentation Mode & Title
36.	5-7 Dec. 2018	10th Bengaluru India Nano-2018	Poster: Structural colour tunability in Ti/TiO2 thin films
37.	20-22 Feb. 2019	International Conference on 'Chemistry and Physics of Materials: Glorious Past and Exciting Future' held at JNCASR, Bangalore	Poster: Tunable structural colour generation in metal/dielectric films
38.	6 Jul. 2018	CeNS-SODET workshop held at BEL, Bangalore.	Participated

Athira M, JRF

No.	Date(s)	Name of Conference	Presentation Mode & Title
39.	22-24 Oct. 2018	9th MRS Trilateral Conference	Poster: Facile fabrication of hybrid perovskite nanorods based solar cells
40.	5-7 Dec. 2018	10th Banglore India Nano-2018	Participated

Swathi S P, JRF

No.	Date(s)	Name of Conference	Presentation Mode & Title
41.	5-7 Dec. 2018	10th Banglore India Nano-2018	Participated

Brindhu Malani S, Student, SRF

No.	Date(s)	Name of Conference	Presentation Mode & Title
42.	5-7 Dec. 2018	10th Banglore India Nano-2018	Poster: Optical studies on gold connected nano shell arrays
43.	29-30 Mar. 2019	Topical meeting on advances in photonics, NISER, Bhubaneshwar	Poster: Optical studies on graded gold nanostructure arrays on glass substrate

Vivek Ramakrishnan, RA

No.	Date(s)	Name of Conference	Presentation Mode & Title
44.	5-8 Oct. 2018	India International Science Festival IISF-2018, Lucknow At Young Scientist's Conference and prototype displayed at CeNS stall	Oral: Modulating the growth of metallic MoO_2 nanostructures with various morphologies enabling it for electro-chemical water activation

Alex C, JRF

No.	Date(s)	Name of Conference	Presentation Mode & Title
45.	7-8 Dec. 2018	Bangalore Nano 2018	Poster: Nickel hydroxide nanowall network on reduced graphene oxide for electrochemical energy generation and storage

Ramya Prabhu B, SRF

No.	Date(s)	Name of Conference	Presentation Mode & Title
46.	12-15 Feb. 2019	First Indian Materials Conclave, MRSI	Poster: Sea urchin -MoO3 nanostructures as an efficient substrate for SERS detection of dyes

Safeer N.K., JRF

No.	Date(s)	Name of Conference	Presentation Mode & Title
47.	20-22 Feb. 2019	ChemPhysMat 2019 International Conference on Chemistry And Physics of Materials: Glorious Past and Exciting Future	Poster: Effect of passivation layers on copper oxide nano-structures for photo-electrochemical catalysis

Amit Kumar Patel, JRF

No.	Date(s)	Name of Conference	Presentation Mode & Title
48.	5 Dec. 2018	10th Bangalore India Nano 2018	Pre event demonstration: Gulliver is red, Lilliput is blue
49.	25–27 Mar. 2019	KSTA-CeNS Joint Workshop	Demonstration – Solar Simulator

Vishnu Priya H. R., ROI Student

No.	Date(s)	Name of Conference	Presentation Mode & Title
50.	5 Dec. 2018	10th Bangalore India Nano 2018	Pre event demonstration: Gulliver is red, Lilliput is blue
51.	25–27 Mar. 2019	KSTA-CeNS Joint Workshop	Demonstration – Solar Simulator

Navyashree V, R&D Asst

No.	Date(s)	Name of Conference	Presentation Mode & Title
52.	5 Dec. 2018	10th Bangalore India Nano 2018	Pre event demonstration: Gulliver is red, Lilliput is blue
53.	25–27 Mar. 2019	KSTA-CeNS Joint Workshop	Demonstration – Solar Simulator

Trupthi Devaiah C., JRF

No.	Date(s)	Name of Conference	Presentation Mode & Title
54.	20- 22 Feb. 2019	10th Bangalore India Nano 2018	Pre event demonstration: Gulliver is red, Lilliput is blue
55.	23 Mar. 2018	ICONSAT 2018	Poster: Origin of Luminescence-Based Detection of Metal Ions by Mn-doped ZnS Quantum Dots
56.	22 Oct. 2018	MRS trilateral conference	Poster: Origin of Luminescence-Based Detection of Metal Ions by Mn-doped ZnS Quantum Dots

Anamul Haque, SRF

No.	Date(s)	Name of Conference	Presentation Mode & Title
57.	21-23 Mar. 2018	ICONSAT 2018	Poster: Internal Heterostructure of Anion Exchanged Cesium Lead Halide ($CsPbX_3$) Nano Cubes
58.	5-8 Sep. 2018	India International Science Festival - Young Scientist Conference (IISF-YSC) at Lucknow	Poster: Internal Heterostructure of Anion Exchanged Cesium Lead Halide ($CsPbX_3$) Nano Cubes
59.	20-22 Feb. 2019	International conference on Chemistry and Physics of Materials (ChemPhysMat)	Poster: Internal Heterostructure and Inter-particle Mixing of Halide Perovskite Nanocrystals

*NPDF: National Post Doctoral Fellow; RA: Research Associate; SRF: Senior Research Fellow; JRF: Junior Research Fellow

19.4 CONFERENCE / SYMPOSIA / SEMINARS / WORKSHOPS ORGANIZED

- KSTA-CeNS PG Special Workshop Basics and Applications of Nano Science and Technology, 25-27 Mar 2019 at CeNS. Coordinators: Dr. S. Krishna Prasad, Dr. PK Santra and Dr. HSSR Matte

- One day workshop organized jointly by Society of Defence Technologists (SODET) C/o BEL, Bengaluru and Centre for Nano and Soft Matter Sciences (CeNS), Bengaluru, July 6, 2018 at BEL Officers Club Bengaluru. Convenors: Dr. D.S Shankar Rao and Prof. G.U.Kulkarni from CeNS, and Mr. N. Ravindra from SODET, Bengaluru. Theme: Introduction to Nanomaterials, Nanoscale phenomena, Exciting properties of Nanomaterials, Application in Energy, Sensors, Catalysis, Theoretical approaches".

- Science Academies workshop on Emerging trends on Nano Science and NanoTechnology, 7 & 8 September 2018, Shivamogga: CeNS participated in the workshop on 'Emerging Trends in Nanoscience and Nanotechnology" organized by Jawaharlal Nehru National College for Engineering, Shivamogga. Prof. G U Kulkarni, Director, CeNS was felicitated by the organizers during the inaugural event for his contributions to Nanoscience and technology. The workshop was sponsored by the Science Academies and three faculty members from CeNS, namely, Prof. G. U. Kulkarni, Dr. Geetha G Nair and Dr.Neena Susan John delivered lectures to graduate students, research scholars and young faculty of the college.

- The 9th MRS Trilateral conference on Advances in Nanomaterials: Energy, Water and Healthcare, was inaugurated on 22nd October 2018 at CeNS, Bengaluru. The conference convened by Prof. G.U. Kulakrni and Dr.Neena S. John was a three day event and was attended by delegates from China, Singapore and India.

- A mega pre-event to Bengaluru INDIA NANO-2018 namely Lecture series, Road-show and Nanoscience Exhibition was held during Oct-Nov 2018. Coordinators: Prof. G.U. Kulkarni, Dr. S. Krishna Prasad, Dr. P. K. Santra and Dr. H. S. S. R. Matte.

Road-show and Nanoscience Exhibition at Kalburgi

Road-show and Nanoscience Exhibition at Manipur

- The first 1ProCoNS workshop "Nanoscience and Technology: Trends and Challenges" organized by CeNS faculty and students was held at R V College of Engineering, Bengaluru, on 8th March 2019

1ProCoNS workshop at Bengaluru

ANNEXURE - A

In Refereed Journals

1. A Novel, Needle-Array Dry-Electrode With Stainless Steel Micro-Tips, for Electroencephalography Monitoring, J. K. Radhakrishnan, S. Nithila, S. N. Kartik, T. Bhuvana, G. U. Kulkarni and U. K. Singh, *J. Med. Devices 12:041001,* **(2018).** IF: 0.412

2. A soft-bent dimer composite exhibiting twist-bend nematic phase: Photo-driven effects and an optical memory device, S. Krishna Prasad, P. Lakshmi Madhuri, PragnyaSatapathy, and C. V. Yelamaggad, *Appl. Phys. Lett. 112, 253701* **(2018)** IF: 3.49

3. A spring network simulation in 3 dimensions for designing optimal crack pattern template to fabricate transparent conducting electrodes. S. Sadhukhan, A. Kumar, G. U. Kulkarni, S. Tarafdar & T. Dutta, *Bull. Mater. Sci* **(2018).** IF: 0.925

4. Amide linkage in novel three ring bent-core molecular assemblies: polar mesophases and importance of H-bonding, G. Mohiuddin, S. Ghosh, N. Begum, S. Debnath, S. Turlapati, D. S. Shankar Rao and N.V.S. Rao, *Liq. Cryst.,45, 1549* **(2018).** IF: 2.636

5. Anisotropic fast electrically switchable emission from composites of CsPbBr3 perovskite quantum cuboids in a nematic liquid crystal P. Satapathy, P. K. Santra, A. Haque, C. V. Yelamaggad, S. Das and S. Krishna Prasad. *Adv. Optical Mater., 1801408* **(2019).** IF: 7.43

6. Confinement of an antiferroelectric liquid crystal in a polymer nanonetwork: thermal and dielectric behaviour, M. Baral, A.P. Ranjitha and S. Krishna Prasad, *Bulletin of Materials Science 41, 135***(2018)** IF: 0.87

7. Confinement-driven radical change in a sequence of rotator phases: a study on n-octacosane, S Dutta, S. Krishna Prasad, *Phys. Chem. Chem. Phys. 20, 24345* **(2018)** IF: 3.9

8. Cosmetically Adaptable Transparent Strain Sensor for Sensitively Delineating Patterns in Small Movements of Vital Human Organs, N. Gupta, K. D. M. Rao, K. Srivastava, R. Gupta, A. Kumar, A. Marconnet, T. S. Fisher, & G. U. Kulkarni, *ACS Appl. Mater. Interfaces, 10 (50), 44126-44133* **(2018).** IF: 8.097

9. Designing Metallic MoO2 Nanostructures on Rigid Substrates for Electrochemical Water Activation, V Ramakrishnan, C Alex, A N Nair, Neena S John, *Chem. Eur. J. 24,18003* **(2018).** IF 5.16

10. Effect of ZnO nanoparticles on the morphology, dielectric, electro-optic and photo luminescence properties of a confined ferroelectric liquid crystal material, DivyaJayoti, Praveen Malik and S. Krishna Prasad, *Journal of Molecular Liquids,* **2018,** 250, 381 IF: 4.51

11. Electrical and room temperature multiferroic properties of polyvinylidene fluoride nanocomposites doped with nickel ferrite nanoparticles, Dhiraj Kumar Rana, Suresh Kumar Singh, Shovan Kumar Kundu, Subir Roy, S. Angappane and SoumenBasu, *New J. Chem.43, 3128* **(2019).** IF: 3.27

12. Enhanced electrocatalytic activity of reduced graphene oxide-Os nanoparticle hybrid films obtained at a liquid/liquid interface, K Bramhaiah, I Pandey, V N Singh, C Kavitha, Neena S John, *J. Nanopart. Res.2, 56* **(2018).** IF 2.12

13. Evaluation of Photocatalytic thin film pretreatment on anaerobic degradability of exopolymer extracted biosolids for biofuel generation, V. Godvin Sharmila, M. Gunasekaran, S. Angappane, Guangyin Zhen, Ick Tae Yeom and J. Rajesh Banu, *Bioresource Technology, 279, 132* **(2019).** IF: 5.8

14. Extraordinary ferromagnetic coupling and magnetodielectric phenomena in NiO nanoparticles, Subir Roy, Rajesh Katoch, and S. Angappane, *IEEE-Trans. Magn.55, 1* **(2019).** IF: 1.47

15. Films and dispersions of reduced graphene oxide based Fe_2O_3 nanostructure composites: Synthesis, magnetic properties and electrochemical capacitance, K Bramhaiah, I Pandey, V N Singh, N Kambhala, S Angappane, Neena S John, *Mater. Chem. Phys.209, 1* **(2018).** IF: 2.2

16. Frustrated Liquid Crystal Phases in Optically Active, Schiff Base Dimers Derived from Cholesterol: Synthesis and Rich Phase Transitional Behavior. Rashmi Nayak, Sachin A. Bhat, G. Shanker and C. V. Yelamaggad. *New J. Chem., 43, 2148-2162* **(2019).** IF: 3.201

17. Grafting a mesomorphic Schiff base onto gold nanoparticle via ester link –photoluminescence, mesomorphism, electrical conductivity and antioxidant activity, N. Das, D. Borah, H. Acharya, S. Choudhury, S. Krishna Prasad, D.S. Shankar Rao, and C.R. Bhattacharjee, *Liq. Cryst.,46 p 609* **(2019).** IF: 2.636

18. Giant enhancement of photoluminescence and tertiary emission in a chiral nematic by matching photonic band gap and excitation wavelength, Marlin Baral, S. Krishna Prasad, Himali Patel, A.S. Achal Kumar, and C.V. Yelamaggad, *Journal of Molecular Liquids, 262, 354* **(2018)** (IF: 4.51)

19. Giant enhancement and facile tuning of photoluminescence in a soft anisotropic magneto-gel, Mohanan, Vaisakh V; Pradhan, Balaram; Sridurai, Vimala; Yelamaggad, Channabasaveshwar V; Achalkumar, Ammathnadu S; Nair, Geetha G; *Nanoscale, 10, 15686-15695,* **(2018)** (IF: 7.233)

20. Graphene-Augmented Polymer Stabilization: Drastically Reduced and Temperature-Independent Threshold and Improved Contrast Liquid Crystal Device, Marlin Baral, KommulaBramhaiah, Neena Susan John, and S. Krishna Prasad, *ACS Omega, 4, 403* **(2019)** (IF: 2.584)

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22. Highly frustrated liquid crystal phases in optically active dimers: synthesis and rich phase transitional behaviour, A.N. Rashmi, S. A. Bhat, G. Shanker, D. S. Shankar Rao, and C. V. Yelamaggad, *New J. Chem., 43, 2148* **(2019).** IF: 3.277

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25. Hydrogen Bond-Driven Columnar Self-Assembly of Electroluminescent D-A-D Configured Cyanopyridones, D. R. Vinayakumara, Hidayath Ulla, S. Kumar, A. Pandith, M. N.Satyanarayan, D. S. Shankar Rao, S. Krishna Prasad, A. V. Adhikari, *J. Mater. Chem. C, 6, 7385* **(2018)** (IF: 5.97)

26. Influence of Iodine Doping on the Structure, Morphology, and Physical Properties of Manganese Phthalocyanine Thin Films, K P Madhuri, Neena S John, S Angappane, P K Santra, F Bertram, *J. Phys. Chem. C122, 28075* **(2018).** IF: 4.5

27. Influence of Zinc oxide nanorods on an orientationally ordered fluid comprising soft-bent dimers. P. Satapathy, S. Parthasarathi, D. S. Shankar Rao, M. Kanakala, C.V. Yelamaggad and S. Krishna Prasad. *Bull. Mater. Sci., 41, 116* **(2018).** IF: 0.925

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31. Impact of ordering of gold nanohole arrays on refractive index sensing,BrindhuMalani, S and Viswanath, P., *Journal of Optical Society of America B 35:2501* **(2018).** IF: 2.048

32. Large magnetoresistance in carbon coated Ni/NiO nanoparticles, Subir Roy, Rajesh Katoch and S. Angappane, *Bull. Mater. Sci.41, 127* **(2018).** IF: 0.92

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34. Metallophthalocyanine-enriched Langmuir-Schaefer multilayers of poly(vinylidene fluoride)-based nanocomposites,Kumar, C. and Viswanath, P., *Journal of Applied Polymer Science 136:47818,* **2019.** Impact factor: 1.9, DOI: 10.1002/app.47818

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38. Nanophase Segregation of Nanostructures: Induction of Smectic A and Re-Entrance in a Carbon Nanotube/Nematic Liquid Crystal Composite, G. V. Varshini, D. S. Shankar Rao, P. K. Mukherjee, and S. Krishna Prasad, *J. Phys. Chem. B, 122, 10774* **(2018).** IF: 3.146

39. Nanometre Confinement-Driven Promotion and Stabilisation of a Hexatic Phase Intervening between Ordered Rotator Phases, S. Dutta, S. Srikantamurthy, P K. Mukherjee and S. Krishna Prasad, *J. Phys. Chem. B, 122, 10953* **(2018)** IF: 3.14

40. Nobler than the Noblest: Noncubic Gold Microcrystallites, G. Mettela, S. Kouser, C. Sow, S. T. Pantelides & G. U. Kulkarni, *Angew. Chem. 57: 9018-9022,* **(2018).** IF: 12.102

41. Novel tris-buffer based Schiff base bearing long flexible alkoxy arm and its lanthanide complexes: Mesomorphism and photoluminescence, HAR Pramanik, C Chanda, PC Paul, CR Bhattacharjee, S Krishna Prasad and D.S. Shankar Rao, *Journal of Molecular Structure 1180, 472-479* **(2019)** IF: 2.01

42. One-Dimensional Porphyrin–Fullerene (C60) Assemblies: Role of Central Metal Ion in Enhancing Ambipolar Mobility, Goudappagouda, M. Gedda, G. U. Kulkarni &S. S. Babu, *Chem. Eur. J., 24, 30, 7695-7701* **(2018).** IF: 5.160

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44. Preparation and photo-physical properties of soft-nano composites comprising guest anatase TiO2 nanoparticle and host hekatesmesogens. D. P. Singh, K. Agrahari, A. S. Achalkumar, C. V. Yelamaggad, R. Manohar, and M. Depriester. *J. Lumin., 205, 304–309* **(2019).** IF: 2.732

45. Self-assembly of taper- and wedge-shaped maleimide derivatives: Synthesis and structure-property relationship, D.R. Vinayakumara, Sandeep Kumar, S. Krishna Prasad and A. Vasudeva Adhikari, *J. Mol. Liq. Doi: 10.1016/j.molliq.2019.02.054* IF: 4.51

46. Single Component Room Temperature Chiral Nematic Liquid Crystals. G. Shanker, P. Pratap, Ravindra Kumar Gupta, A. S. Achalkumar and C. V. Yelamaggad. *J. Mol. Liq. 275, 849–858* **(2019).** IF: 4.513

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51. Transmuting the blue fluorescence of hekatesmesogens derived from tris(N-salicylideneaniline)s core via ZnS / ZnS:Mn2+ semiconductor quantum dots dispersion. D. P. Singh, A.K. Misra, A.S. Achalkumar, C.V. Yelamaggad and M. Depriester. *J.Lumin., 210, 7–138* **(2019).** IF: 2.732

52. Triboelectric Nanogenerator Based on Biocompatible and Easily Available Polymer Films, S. R. Srither, D. S. Shankar Rao, and S. Krishna Prasad, *ChemistrySelect, 3,5055* **(2018).** IF: 1.505

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54. Tuning the fluorescence behavior of liquid crystal molecules containing Schiff-base: Effect of solvent polarity. A. K. Satapathy, S. K. Beherac, A. Yadavd, L. N. Mahourd, C.V. Yelamaggad, K.L. Sandhya and Balaram Sahoo. *J. Lumin., 215, 304–309* **(2019).** IF: 2.732

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1. Charge transport in a system of cholesterol molecules deposited on graphene oxide using current sensing atomic force microscope, Arup Sarkar, K. A. Suresh, H. N. Gayathri, *Materials Today: Proceedings* **(2018)** (in press)

2. Magnetocapacitance effect in core/shell NiO nanoparticles, S. Roy, N. Kambhala, S. Angappane, *AIP Conf. Proc.1942, 050082* **(2018).**

3. Relation between textured surface and diffuse reflectance of Cu films, G. Shukla, S. Angappane, *AIP Conf. Proc.1942, 050137* **(2018).**

4. Reduced Graphene oxide/Nanoparticle hybrid structures: A new generation smart materials for optical sensors, C Kavitha, K Bramhaiah, NS John, *Materials Today: Proceedings5, 2609-2618* **(2018).**

5. Films of Reduced Graphene Oxide-Based Metal Oxide Nanoparticles. Nanoelectronic Materials and Devices. *Lecture Notes in Electrical Engineering, Springer466, 19-27* **(2018)**

6. UV light enhanced confined Fréedericksz transition in photoisomerizablenematic nanocomposite with photoactive molecules of azobenzene nematic liquid crystal, YG Marinov, GB Hadjichristov, AG Petrov, S Krishna Prasad, *AIP Conference Proceedings 2075, 020020* **(2019)**

7. Thermal properties and structure of nematic liquid crystalline polymer nanocomposite with single wall carbon nanotubes, GK Exner, YG Marinov, GB Hadjichristov, VK Shumanov, S Krishna Prasad, *AIP Conference Proceedings 2075, 020019* **(2019)**

Technical Reports / Monographs / Books

1. "Synthesis, Properties and Applications of Graphene" in Book: "Fundamentals and Sensing applications of 2D materials" Publisher: Elsevier, Authors: Shivam Trivedi, Kenneth Lobo, H.S.S. Ramakrishna Matte

ANNEXURE - B

V4 Science Programme @ CeNS

No.	Date	Institution Name & Address	Participation Details		Topic
			Student	Staff	
1.	27.03.2019	KSTA-CeNS PG Special Workshop	70	5	Rediscovering the Periodic Table of Chemical Elements
2.	02.07.2018	Jawaharlal Nehru Centre for Advanced Scientific Research	130	20	How to make Gold nobler
3.	11.10.2018	Karnataka High School Dharwad	10	3	Glimpses to the Nano World
4.	29.03.2019	Govindram Seksaria Science College, Tilakwadi, Belagavi	42	8	Photonic Band Gap & Photoluminescence in anisotopics emitters
5.	25-27 Mar. 2019	Different Universities of Karnataka State	85		Rheology of Soft Materials
6.	09.06.2018	Sheshadripuram College, Yelahanka, Bangalore	35	3	Visible and Invisible Light
7.	07.07.2018	BEL PUC-II college	40	4	How can crystals be liquids?
8.	12.01.2019	PSMO College, Tirurangad, Kerala	80	4	Liquid Crystals : Science and Technology
9.	04.08.2018	Iyer School, Gokula Extension Bangalore	40	4	How can crystals be liquids?
10.	13.10.2018	Lions School, Raichur	80	4	Chemistry in day-to-day life
11.	03.01.2019	Reva University School of Apllied Science (Physics)	12	2	Nanolithography
12.	11.08.2018	Vijaya Degree College, Jayanagar	35	2	Energy from Water
13.	21.12.2018	Farook College, Kozhikode, Kerala	40	2	Digital, characterisation lab and prototype gallery
14.	17.11.2018	Pratham School, Varthur, Bangalore	35	2	Nano materials for solar cells
15.	28.02.2019	Reva Degree College	44	2	Science for the People & the People for Science

V4 Science Programme @ your Institution

No.	Date	Institution Name & Address	Participation Details		Topic
			Student	Staff	
1.	13.10.2018	Regional Science Center Karnataka University Campus Dharwad	250	15	From Laboratory Inventions to Technology Products
2.	15-17 Feb. 2018	Department of Chemistry, Bharathiar University,	70	10	New Forms of Au Crystallites are Nobler than Gold
3.		Coimbatore	68	10	Graphene Multistacks but not Graphite
4.	20.06.2018	Navkis Eductional Institution, Bengaluru	120	15	Liquid Crystals, Laptop and Life
5.	29.07.2018	Yuva Vijnani Prashasti Sammelana KRVP, Bengaluru	150	5	Liquid Crystals, Laptop and Life
6.	08.09.2018	Science Academies Lecture Workshop, Vijaya College	150	25	The ubiquitous soft matter

No.	Date	Institution Name & Address	Participation Details		Topic
			Student	Staff	
7.	05.10.2018	Sidaganga Institute of Technology, Tumkuru	100	10	Liquid Crystals: an engineer's dream material
8.	10.11.2018	Bangalore Nano Pre-event Lecture Series, Road-show and Nanoscience Exhibition, Mangalore	275		Mobile Phones Work because of Crystals that Flow
9.	16.11.2018	HEA, Dharwad(Indian Academy of Science programme)	~200		Liquid Crystals, LCD and Life
10.	20.11.2018	Bangalore Nano Pre-event Lecture Series, Road-show and Nanoscience Exhibition, Tumakuru	~300		Nano prapanchakkeonduinaku nota
11.	27.11.2018	Bangalore Nano Pre-event Lecture Series, Road-show and Nanoscience Exhibition, Bangalore	~200		Mimicking Nature
12.	28.11.2018	Bangalore Nano Pre-event Lecture Series, Road-show and Nanoscience Exhibition, Bangalore	~200		Science & Technology of LCDs
13.	08.03.2019	R V College of Engg., Bengaluru	120	30	Liquid Crystals: an engineer's dream material
14.	14.02.2019	Reva University, Bengaluru	50	5	Rheology of Soft Materials
15.	14.02.2019	Shri J C B M College, Sringeri	300	10	Soft Matter, Hard Science
16.	7- 8 Sept. 2018	JNNCE, Shivamogga.	200	10	Soft Matter Energy Efficient Anisotropic Gels
17.	17.08.2018	Smt Indira Gandhi Women College, Sagara	300	10	Visible and Invisible Light
18.	05.01.2019	Sri Gavisiddeshwara Science College, Koppal	Around 400 undergraduate students from all over Karnataka and Teachers		Visible and Invisible Light
19.	21.07.2018	Laxmi Venkatesh Desai College, Raichur	200	12	Liquid Crystals
20.	21.07.2018	Mother Teresa School, Raichur	300	16	Different States of Matter
21.	04.09.2018	Basaveshwar Science college, Bagalkot	300	20	How can crystals be liquids?
22.	04.09.2018	Basaveshwar Girls High School, Bagalkot	400	08	Invisibility: Science and Technology
23.	05.09.2018	D. V. Darbar PU College, Vijayapur	350	20	How can crystals be liquids?
24.	05.09.2018	S. B Arts & KCP science college, Vijayapur	200	15	How can crystals be liquids?
25.	18.08.2018	Smt. Indira Gandhi Women College, Sagara	350	10	Nanolithography
26.	01.03.2019	Reva Science Degree College, Bangalore	155	10	Solar cells
27.	06.03.2019	Annual fest – InPhyNITT 2019 Dept. of Physics, NIT Tiruchirapalli	130	12	Thin film polymorphism and growth mechanisms in organic semiconductors
28.	05.10.2018	SIT, Tumkur	100	10	Synthesis and Characterization of Nanomaterials

No.	Date	Institution Name & Address	Participation Details		Topic
			Student	Staff	
29.	10.04.2019	CMR Institute of Technology, Bengaluru, Karnataka.	50	10	Nanomaterials for Solar Cells
30.	08.03..2019	RV College of Engineering, Bengaluru, Karnataka	120	30	Introduction of Nanomaterials
31.	19.02.2019	Department of Chemistry, BMSIT, Bangalore, Karnataka	100	12	Quantum Dots and their a few Applications
32.	27.11.2018	BMS College of Engineering, Bengaluru Karnataka			Introduction of Nanomaterials
33.	15.10.2018	Indian Institute of Technology - Jodhpur, Rajasthan	280	6	Introduction of Nanomaterials
34.	05.10.2018	Siddaganga Institute of Technology, Tumakuru, Karnataka	100	10	Nanomaterials: Another Way to Tackle Energy Crisis
35.	21.07.2018	Ideal Jawa School, Mysore, Karnataka	110	10	Nanomaterials for Solar Cells
36.	20.06.2018	Navkis Educational Centre, Bengaluru, Karnataka	120	15	Nanomaterials for Solar Cells
37.	03.05.2018	Global academy of Technology – 2 talks	120	30	Nanoscience: The New and Big Science of Small An Overview of New Generation Solar Cells.
38.	30.07.2018	Saradha PU college at Mangalore – 2 talks	560 400	15 20	Nanoscience: The New and Big Science of Small An Overview of New Generation Solar Cells.
39	07.09.2018	Vijaya College, Jayanagar, Bengaluru	150	25	Nanoscience: The New and Big Science of Small 2) An Overview of New Generation Solar Cells
40.		Bengaluru India Nano pre-event and delivered lectures in Vijayawada, Bengaluru North, Bengaluru South, Raichur, Gulbarga, Dharwad, Jaipur, New Delhi, Pune Mumbai and Manipur.	About 300 students and 10-15 staff attended each event.		The event held in several places and several researchers gave lectures related to nano science

ANNEXURE - C

Sl. No.	Name of ROI student	Name of the Parent Institute	Mentor
1.	Ms. Anu Vashishtha	RRI, Bangalore	Prof. G. U. Kulkarni
2.	Mr. S. Nageswar Reddy	Madanapalle Institute of Technology & Science (affiliated to JNTU-A), Kurbalakota	Prof. G. U. Kulkarni
3.	Mr. Monish Kumar	Jawaharlal Nehru National College of Engineering, Shivamogga	Dr.S.Krishna Prasad
4.	Ms. A.P. Ranjitha	The National College Jayanagar, Bangalore	Dr. S. Krishna Prasad
5.	Ms. Sarika S. Joshi	Mount Carmel College, Bengaluru	Dr. S. Krishna Prasad
6.	Ms. C.A. Soukhya	Dayananda Sagar College of Engineering, Bangalore	Dr. S. Krishna Prasad
7.	Mr. Raghavendra Adiga	Dayananda Sagar College of Engineering, Bangalore	Dr. S. Krishna Prasad
8.	Mr. Arcot Yashwanth	IIT Guwahati	Dr. Geetha G. Nair
9.	Ms. Praffulla S R	Christ (Deemed to be University)	Dr. Geetha G. Nair
10.	Ms. Aswathi B Nair	Central University, Rajasthan	Dr. Geetha G. Nair
11.	Ms. Renu Yadav	Delhi University, Delhi	Dr.D.S.Shankar Rao
12.	Mr. Ashish Raghavan	University of Mysore, Mysore	Dr.D.S.Shankar Rao
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