# वार्षिक रिपोर्ट
# ANNUAL REPORT
# 2017-18


## नैनो एवं मृदु पदार्थ विज्ञान केंद्र

विज्ञान एवं प्रौद्योगिकी विभाग, भारत सरकार के अधीन एक स्वायत संस्था

## CENTRE FOR NANO AND SOFT MATTER SCIENCES

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

ZZm Ed _X nXmW {dkmZ H Đ

{dkmZ Ed àmÚm{JHr {d^mJ, ^maV gaHma H AYrZ EH ñdm`V gñWm

# CENTRE FOR NANO AND SOFT MATTER SCIENCES

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

dm{fH [anmQ

# ANNUAL REPORT

# 2017-18

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

# CONTENTS

# FOREWORD

Centre for Nano and Soft Matter Sciences (CeNS) with its new mandate has entered into the fifth year. The in-house inventions are steadily progressing towards realising flexible, ergonomic futuristic technology. 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 realisation. The Centre has embarked on collaborative activity with well-known industries. It is growing in strength to new heights serving the society at large.

Outreach programmes of the Centre launched two years ago, {dk{Z-{dÚ{W {dMa {d{Z_` (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 enhanced vigour. A new programme, Tech Buddy, meant to provide momentum to translational activities has been launched. Increasingly a large number of students are being enrolled for research programmes leading to PhD, in the area of nanoscience and technology. During the year 2017-18, lab facilities such as glove box for solar cell fabrication have been commissioned. Several new interactive technology displays have added to the Centre's Prototype Gallery. These facilities are attracting a large number of academic and industry visitors to the campus. Extramural and industrial projects were undertaken during the year. The sensor lab is being upgraded to include facilities to carry out the 'Nanonose' project of the Centre. 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 biennial event, International Conference on Nanoscience and Technology, under the aegis of DST Nano Mission, GoI.

The Centre is expanding its activities at the new campus located at Shivanapura. It is being constantly mentored by eminent scientists, administrators as well as policy makers, in particular by the Nano Mission of the Government of India.

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, comprising a few science labs and administrative office is ready for occupation on its new campus at Shivanapura, Bangalore North Taluk. The Centre also has set up incubation units with basic facilities for fostering technology development activities.

With the extended responsibility, the Centre 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

**Chairman**

**Bharat Ratna Professor C. N. R. Rao, F.R.S.**
National Research Professor and
Honorary President & Linus Pauling Research Professor,
Jawaharlal Nehru Centre for Advanced Scientific Research
Jakkur, Bengaluru – 560 064

**Professor Ashutosh Sharma** — **Member**
Secretary to the Government of India
Department of Science and Technology Technology Bhavan
New Mehrauli Road, New Delhi – 110 016

**Shri J.B. Mohapatra** — **Member**
Joint Secretary & Financial Adviser
Department of Science and Technology Technology Bhavan
New Mehrauli Road, New Delhi – 110 016

**Professor R. Narasimha, F.R.S.** — **Member**
DST Year-of-Science Professor
Jawaharlal Nehru Centre for Advanced Scientific Research
Jakkur P.O., Bengaluru – 560 064

**Professor A. K. Sood, F.R.S.** — **Member**
Professor
Department of Physics
Indian Institute of Science, Bengaluru – 560 012

**Dr. A. T. Kalghatgi** — **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

*(One vacancy has arisen on account of Prof. Ashutosh Sharma's assumption of charge as Secretary, DST)*

# 3. RESEARCH ADVISORY BOARD

| | |
|---|---|
| **1. Professor D.D. Sarma**<br>Indian Institute of Science | **Chairman** |
| **2. Professor V. Ramgopal Rao**<br>Director, Indian Institute of Technology-Delhi | **Member** |
| **3. Professor M.K. Sanyal**<br>Saha Institute of Nuclear Physics | **Member** |
| **4. Professor George K. Thomas**<br>IISER – Thiruvananthapuram | **Member** |
| **5. Professor Ashok K. Ganguli**<br>Indian Institute of Technology-Delhi | **Member** |
| **6. Shri Chandrasekhar B. Nair**<br>Head and Founder Director, Bigtec Labs | **Member** |
| **7. Professor G.U. Kulkarni**<br>Director, Centre for Nano and Soft Matter Sciences | **Convener** |

# 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. P. Viswanath | Scientist D |
| 9. | Dr. S. Angappane | Scientist D |
| 10. | Dr. Neena Susan John | Scientist D |
| 11. | Dr. Pralay K. Santra | Scientist D (on contact) |
| 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 | Administrative Officer |
| 2. | Mr. Vivek Dubey | Accounts Officer |
| 3. | Ms. P. Nethravathi | Office Superintendent |
| 4. | Dr. Sanjay K. Varshney | Technical Assistant |
| 5. | Ms. Sandhya D. Hombal | Technical Assistant |
| 6. | Mr. M. Jayaram | Assistant |
| 7. | Ms. Nayana .J. | Library Assistant |
| 8. | Mr. Samuel V. Hebich | Support Staff |
| 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) |

# 5. RESEARCH AND DEVELOPMENT ACTIVITIES

## Transparent & flexible electronics

Visibly transparent yet electrically conducting materials are rare. Conventionally used tin doped indium oxide is quite expensive. Transparent conductors made from our invention, invisible metal nanomesh, provide affordable solutions besides adding many novel features. Using nanomesh electrodes, many optoelectronics and optoelectrical devices have been fabricated including touchscreens, EMI shields and smart windows.

*See: J. Mater. Chem. C, 5, 5917 (2017).*

**Investigators:** Ashutosh K. Singh, S.Kiruthika, Indrajit Mondal and G.U. Kulkarni

## Twisted Graphene stacks

The extraordinary properties of graphene are truly observable when it is suspended, being free from any substrate influence. In this work, a new type of multilayer graphene system has been made wherein each layer is turbostratically decoupled, resembling the suspended graphene, while maintaining high degree of 2D crystallinity.

*See: J. Phys. Chem. C, 121 (25), 13938 (2017).*

**Investigators:** Umesha Mogera, Sunil Walia and G. U. Kulkarni

**Collaborators:** Bharath Bannur and Murali Gedda, Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru

## Unusual forms of Gold

Inducing lattice strain in crystals may cause structural transformation and the same has been achieved in the case of gold, by stabilizing nanocorrugated morphologies. This 'microrice gold' is more nobler than the conventional gold; it stands aquaregia and mercury treatments and exhibits interesting catalytic properties!

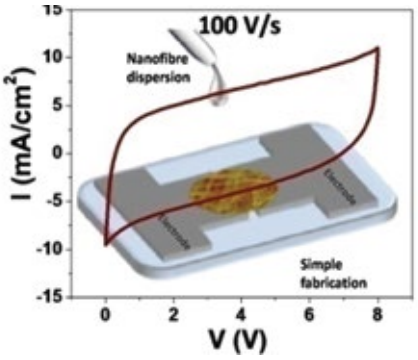
*See: Chem. Mater., 29 (4), 1485 (2017).*

**Investigators:** G.U. Kulkarni

**Collaborators:** Gangaiah Mettela, Yesudhas A. Sorb and Chandrabhas Narayana, Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru; Abhay Shukla and Christophe Bellin, IMPMC, UPMC Sorbonne Universites, France; Volodymyr Svitlyk and Mohamed Mezouar, ESRF, Grenoble, France

## Supramolecular devices

Supramolecules particularly in the form of nanofibres offer advantages in electrical transport as they are essentially 1D systems. Using nanofibres built via self-assembly of donor and acceptor molecules, high mobility FET, supercapacitors and ultrafast humidity sensors have been fabricated. The latter have been applied to measure humidity in human breath dynamically.




**Supramolecular Supercapacitor**

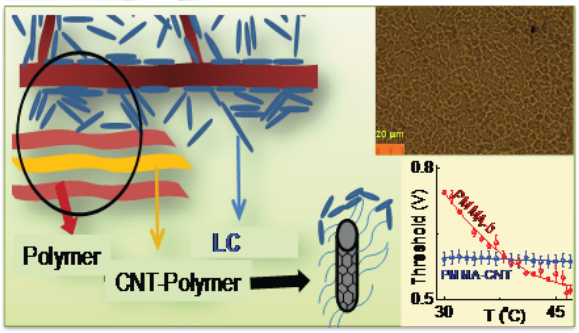
*See: ChemNanoMat, 3 , 39 (2017).*

**Investigators:** Umesha Mogera and G.U.Kulkarni

**Collaborators:** Murali Gedda and Subi J. George, Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru

## Carbon nanotube reinforced polymer stabilized liquid crystal device

Polymer stabilized liquid crystal (PSLC) devices comprise a polymer matrix in an otherwise continuous phase of liquid crystal. The fibrils of the polymer provide, even in the bulk, virtual surfaces with finite anchoring energy resulting in attractive electro-optic properties. Here we describe a novel variation of the PSLC device fabricated by reinforcing the polymer matrix with polymer-capped single-walled carbon nanotubes (CNTs). The most important outcome of this strengthening of the polymer strands is




that the threshold voltage associated with the electro-optic switching becomes essentially temperature independent in marked contrast to the significant thermal variation seen in the absence of the nanotubes. The reinforcement reduces the magnitude of the threshold voltage, notably accelerates the switching dynamics and the effective splay elasticity. Each of these attributes is quite attractive from the device operation point of view, especially the circuit design of the required drivers.

*See: ACS Appl. Mater. Interfaces, 9, 26622 – 26629 (2017)*

**Investigators:** S. Krishna Prasad and Marlin Baral

**Collaborators:** A. Murali and S. N. Jaisankar, CLRI, Chennai

## Effect of ZnO nanoparticles on the morphology, dielectric, electro-optic and photo luminescence properties of a confined ferroelectric liquid crystal material

Varying the concentration of ZnO nanoparticles (NPs) in the host system is found to have a profound impact on the morphology of the polymer dispersed ferroelectric liquid crystal (PDFLC) composites. With increasing ZnO-NP content, the real and imaginary parts of the permittivity and the dielectric strength of a relevant relaxation mode depict an increase. However, the associated relaxation frequency shifts to lower values; a concomitant increase in spontaneous polarization is also observed. The response time of the composites slightly improved on doping with the ZnO-NPs. The observed behaviour is explained in terms of change in elastic energy as well as surface morphology of the composites. Interestingly, the polymer/liquid crystal environment is also seen to enhance the photoluminescence response of confined FLC.
*See: Journal of Molecular Liquids, 250, 381(2018)*

**Investigators:** S. Krishna Prasad

**Collaborators:** Divya Jayoti, Praveen Malik, Dr B R Ambedkar National Institute of Technology, Jalandhar

## Transforming a C3-Symmetrical Liquid Crystal to a π-Gelator by Alkoxy Chain Variation

The self-assembly properties of three C3-symmetrical molecules based on oligo(p-phenylenevinylene), C3OPV1–3, molecules have been studied in the solid and solution states, and are found to follow the isodesmic self-assembly pathway. One variant formed a columnar phase with two-dimensional rectangular lattice, retaining the LC phase even at room temperature. Reducing the number of peripheral substituents, transforms the system to be an organic gelator.
*See: ACS Omega 3, 4392(2018)*

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

**Collaborators:** A. Sandeep, V. K. Praveen, and A. Ajayaghosh, CSIR-National Institute for Interdisciplinary Science and Technology (CSIR-NIIST), Thiruvananthapuram

## Viologen-Based Conjugated Covalent Organic Networks via Zincke Reaction

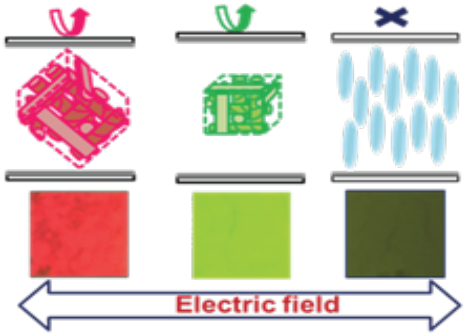
Morphology influences the functionality of covalent organic networks and determines potential applications. Here we describe ultra-stable porous viologen-linked covalent organic polymeric network with hollow structure in both solvothermal and microwave conditions. Depending on solvent polarity, the resulting polymeric network adopt the morphology of uniform hollow spheres (HS), which are formed via the inside-out Ostwald ripening mechanism, or hollow tubes (HT). Tuning the conditions formation of a very strong organogel, organized in few-layer-thick 2D covalent organic nanosheets (CONs), is observed. In gel phase the nanosheets are of crystalline nature, forming honeycomb layers.

*See: J. Am. Chem. Soc., 139, 9558 (2017).*

**Investigators:** S. Krishna Prasad, D. S. Shankar Rao and S. Vimala

**Collaborators:** G. Das,T. Skorjanc,S. K. Sharma, R. Jagannathan and A.Trabolsi, New York University, UAE, F. Gandara, Instituto de Ciencia de Materiales de Madrid – CSIC, M. Lusi, University of Limerick, Republic of Ireland, J. Raya, CNRS/Université de Strasbourg, France, D. S. Han, Texas A&M University at Qatar, Qatar, J.C. Olsen, University of Rochester, USA

## Electrically tunable soft photonic gel formed by blue phase liquid crystal for switchable colour-reflecting mirror




Blue phase liquid crystals (BPLC) with their inherent periodic cubic structure can be considered as 3D photonic crystal systems with stop band in visible wavelengths. In this work, the effect of gelation on the electric field driven tuning of photonic band gap is explored in a BPLC by adding a low molecular weight organogelator. The wavelength tunability is reversible and the switching of the selective reflection colour between red (zero field) and green (with field) is highly repeatable. The highlight of the study is that the reflecting coloured BP can be driven to helix unwound nematic state at higher fields bringing in the possibility to fabricate a tunable mirror device. *See: ACS Appl. Mater. Interfaces, 2017, 9, 39569-39575*

**Investigators:** S. Vimala and Geetha G. Nair

**Collaborators:** M. Mathews and C. V. Yelamaggad

## Helical Twisting Power change-induced pitch modulation of cholesteric LC

Cholesteric LC (CLC), due to the presence of macroscopic helix, give rise to finger print texture acting like a diffraction grating with a periodicity in the range of a few to tens of micrometers. The pitch of the helix, responsible to the grating can be easily tuned by external fields such as temperature, electric field, optical field etc. In the present study, a CLC obtained by the addition of small concentration of a chiral dopant to a nematic LC exhibited a right handed helical pitch at ambient temperatures. Upon heating, pitch diverges leading to unwinding of the helix resulting in a compensated nematic phase. On further heating the composite, a left-handed helical superstructure is formed before finally transforming to the isotropic phase. Such tunability of helical pitch and thus the grating spacing is promising in beam steering applications.

*See Adv. Mater. 2017, 29, 1700676(1-5)*

**Investigators:** Uma S. Hiremath and Geetha G. Nair

**Collaborators:** C. V. Yelamaggad and Q. Li & group, Kent State University, USA

## TENG Based on Biocompatible and Easily Available Polymer Films

We have fabricated robust triboelectric nanogenerators (TENGs) employing different polymer films which are biocompatible and easily available. The TENG with polyurethane+PTFE combination provide the highest TENG parameters, viz., open circuit

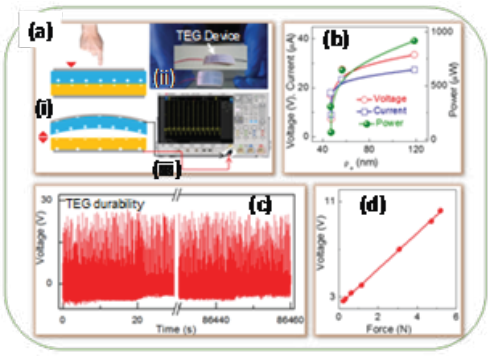



*Figure (a) (i) Schematic representation of the TENG in operation, (ii) Photograph of the TENG and (iii) a representative output of the device (b) Power response vs. combined surface roughness $\rho_a$ ) of polymer films for applied force 0.33N; (c) Demonstration of the mechanical endurance of the TENG; (d) Linear dependence of the output voltage on the applied force for the self-powered pressure sensor*

voltage 33.5 V & a current 27.4 microampere with a gentle tapping force of 0.33 N. We find a very good, albeit non-linear, correlation between the TENG electrical output & the surface roughness of employed polymer films. The TENG device with cellulose acetate and Kapton as the triboelectric layers, we have constructed a simple force sensor, whose output is highly linear with force varying from 0.24 to 5.2 N, and a significantly high output of 1.5 V/N.

*See: Chemistry Select, (in press) DOI: 10.1002/slct.201800685.*

**Investigators:** S R. Srither, D.S. Shankar Rao and S. Krishna Prasad

## Influence of chirality on the thermal and electric properties of the columnar mesophase exhibited by homomeric dipeptides

The first investigation of the influence of chirality on the thermal and electric properties in a biologically important dipeptide molecule that exhibits a hexagonal columnar liquid crystal phase is reported. The enantiomeric excess, taken as a measure of chirality, is seen to significantly govern various physical parameters, viz., (i) the relaxation frequency and activation energy of a mode that is connected with the antiferroelectric nature of the columnar structure, (ii) the polar order, a measure of which is the magnitude of the axial polarization, (iii) unprecedented level of the enantiomeric dependence of Tc-the columnar-isotropic transition temperature, being more than an order of magnitude larger than seen in the well known rod-like chiral-racemic systems. Dielectric relaxation measurements at elevated pressures on one of the enantiopures and the mixture brings out the feature that the value of activation energy is controlled by the chirality of the medium.

*See J. Chem. Phys. 147, 134905 (2017)*

**Investigators:** Srividhya Parthasarathi, D. S. Shankar Rao, Rashmi Prabhu, C. V. Yelamaggad and S. Krishna Prasad

## Xray diffraction studies on Perylene Bisimides

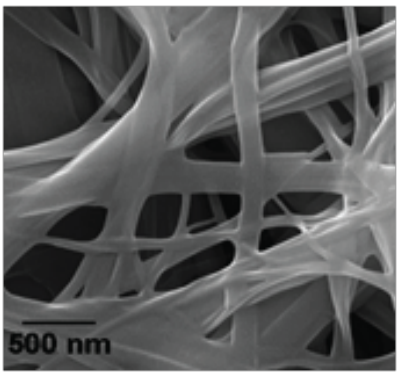
Perylene bisimides due to their electron withdrawing imide substituents serve as electron deficient n-type semiconductors. Xray diffraction experiments has been carried out newly synthesized nitrogen (N), sulphur (S) and selenium (Se) perylene bisimides. XRD studies on material PBI-N showed intense sharp peak followed three low angle peaks which are in the ratio of $1:1/\sqrt{3}:1/\sqrt{4}:1/\sqrt{7}$, characteristic of hexagonal columnar phase. The wide angle showed two diffuse peaks, attributed to floppy alkyl chains and the second one arising due to packing of aromatic cores. This Colh phase existed over wide temperature range. More interestingly it showed Colh-Colh transition with a glass phase at lower temperature. The sulphur substituted PBI-S showed single Colh phase over the entire temperature range. The selenium substituted material PBI-Se showed high temperature Colh phase which transformed to low temperature oblique columnar phase with tilt of the columns being about $\gamma = 69.9o$. As supporting evidence the presence of these phases are explained based energy minimized molecular structure and a molecular model.

*See: Chem. Eur. J. 24, 3566 (2018).*

**Investigators:** D. S. Shankar Rao, S. Krishna Prasad

**Collaborators:** R. K Gupta, A. S. Achalkumar

## Nematic liquid crystals composed of smectic nanoclusters and capable of forming organogels:




**Xerogel formed by dimer in acetone**

Nematic liquid crystals composed of smectic nano clusters, is a topic of much interest after the claims of biaxial nematic phase in bent-core mesogens. Four series of azo dimers forming smectic nano clusters in their nematic mesophases have been synthesized and

investigated. Some of the dimers form organogels which are thermo as well as photo-sensitive, the property that can be exploited for practical applications.

*See: New. J. Chem., 41, 11576 (2017).*

**Investigators:** Monika M and Veena Prasad
**Collaborators:** Arun Roy, Raman Research Institute, Bengaluru.

## Mesogens composed of achiral non-linear molecules

Mesogens composed of achiral non-linear molecules have attracted considerable interest due to the chirality and polarity of some of the mesophases exhibited by such compounds. The compounds forming orthogonal polar smectic mesophases, such as SmAPA and B5 are of technological importance. The first observation of a B5 mesophase and a direct transition of the isotropic phase to a polar biaxial smectic A mesopahse (SmAPA) in V-shaped compounds with acute angle is reported.

*See: J. Mol. Liq., 249, 97 (2018).*

**Investigators:** Rekha S. Hegde, Jitendra Kumar, Veena Prasad and Monika M.

## Thermally stable bent-core nematics composed of smectic nanoclusters

In an effort to synthesise thermally stable bent-core nematogens with fairly low transition temperatures and wide nematic mesophase range, five new series of azo-substituted bent-core compounds without Schiff's base unit are synthesised. XRD studies indicated the presence of smectic nanoclusters in the nematic mesophases of these compounds. Domains of opposite handedness in the nematic phases are observed. The electro-convection pattern study showed that these nematics are of negative dielectric anisotropic in nature. The compounds synthesised here exhibit photo-switching both in their solution and nematic mesophases, a property that can be exploited for practical applications.

*See: Liq. Cryst., 45, 666-679 (2018).*

**Investigators:** Veena Prasad, N. G. Nagaveni and Monika M.

## Temperature-dependent FTIR and density functional theory approach of a V-shaped liquid crystal

Temperature-dependent Fourier transform infrared spectroscopy (FTIR) combined with density functional theory (DFT) is employed to study the mechanism of phase transitions of a V-shaped liquid crystal. A detailed analysis of vibrational normal modes of conformer I (see the paper for the structure) have been done on the basis of potential energy distribution. The good agreement between the calculated spectrum of conformer I and observed FTIR spectrum at room temperature validates our theoretical structure mode Combined FTIR and PES study beautifully explained the dynamics of the molecules, molecular realignment, H-bonding, and conformational changes at the phase transitions.

*See: Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy 188, 561-570 (2018).*

**Investigators:** Veena Prasad

**Collaborators:** Swapnil Singh, Harshita Singh, T. Karthick, Poonam Tandon, University of Lucknow, Lucknow, India

## Observation of ferroelectric nematic and ferrielectric smectic mesophases in an achiral bent-core mesogen

Ferroelectric nematic and ferrielectric smectic mesophases in an achiral bent-core azo compound consisting of non-symmetrical molecules with a lateral fluoro substitution on one of the wings are observed. The nematic mesophase is composed of skewed cybotactic clusters and in the smectic mesophase, the molecules are tilted with respect to the layer normal. The formation of local polar order in these clusters leads to a ferroelectric-like polar switching in the nematic mesophase. Of particular interest is the fact that the smectic phase exhibits field induced ferrielectric state, which can be exploited for designing of the potential optical devices due to multistate switching.

*See: J. Phys. Chem. B, 122, 2998-3007 (2018).*

**Investigators:** Jitendra Kumar and Veena Prasad

## Ferroelectric liquid crystals for display devices

Ferroelectric smectic C (SmC*) phase has been well-used in developing high-resolution microdisplays that have been effectively employed for the fabrication of a wide verities of portable devices. The design, synthesis and characterization of twenty new optically active, three-ring calamitic mesogens exhibiting SmC* phase over a wide thermal range (~ 80-115$^0$) possessing spontaneous polarization ($P_S$) value in the range of 69 to 96 nC/cm$^2$ have been carried out.

*See: Chem. Asian J., 13, 1012 (2018)*

**Investigators:** B. N. Veerabhadraswamy, D. S. Shankar Rao and C. V. Yelamaggad

## Technologically significant, inexpensive materials exhibiting chiral nematic phase at room temperature.

Room temperature (RT) chiral nematic (N*) phase has been utilized as an active organic component in fabricating a wide range of commercial devices. Thus, there is an incredible demand for the materials showing N* phase at / near RT. We have rationally designed, synthesized and characterized new chiral materials namely, non-symmetric dimers derived from cholesterol displaying RT N* phase over a wide thermal range. The N* phase shows temperature-dependent selective reflection of light.

*Indian Patent (filed): 201741034439 dated 28-09-2017*

**Investigators:** C. V. Yelamaggad

**Collaborators:** G. Shanker, Bangalore University, Bengaluru

## Gold nanoparticles (GNPs) functionalized with liquid crystals

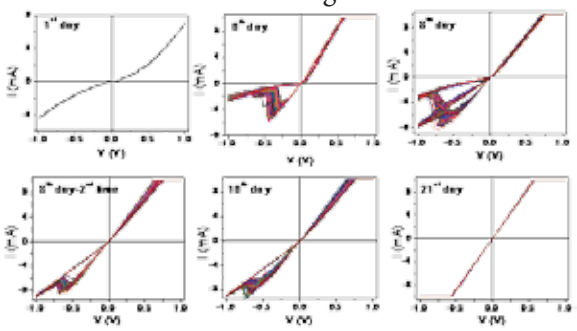
Several monodisperse liquid crystal-gold nanoparticles (LC-GNPs) self-assembling into fluid / frozen lamellar structure exhibiting chirooptical effect have been prepared and characterized. They have been realized by two simple and hassle-free protocols; their molecular structure, mesomorphism and ability to interact with circularly polarized (CD) light have been evidenced unambiguously

**Indian Patent (filed):** 201841001456 date:12/01/2018

**Investigators:** Sachin A Bhat, D. S. Shnakar Rao, Geetha G. Nair, S. K. Prasad, and C.V. Yelamaggad.

## Resistive switching in ZnO thin film

We have studied the resistive switching in RF sputtered ZnO thin films deposited on $Pt/TiO_2/SiO_2/Si$ substrate with two different top electrodes, such as Ag and Al. For a taken deposition condition, the devices showed the resistive switching behavior after few days of deposition of the top electrode and it disappeared after few weeks. We have shown the aging-based filament formation and found the increase of conducting filaments above a threshold ends the switching.



**Resistive switching (I-V characteristics) study of Ag/ZnO/Pt device from 1st day to 21st day.**

*See: Phys. Status Solidi B, DOI: 10.1002/pssb.201700208. Impact Factor: 1.674*

**Investigators:** Nagaiah Kambhala, S. Angappane

## Magnetic and magnetotransport properties of Bi doped $La_{0.67}Sr_{0.33}MnO_3$

In search of new multiferroic materials, Bi with lone pair of electrons was doped in the well-known ferromagnetic compound, $La_{0.67}Sr_{0.33}MnO_3$. We observed competition of ferromagnetic and antiferromagnetic phases and large magnetoresistance.

*See: Phys. Status Solidi B, DOI: 10.1002/pssb.201700194. Impact Factor: 1.674*

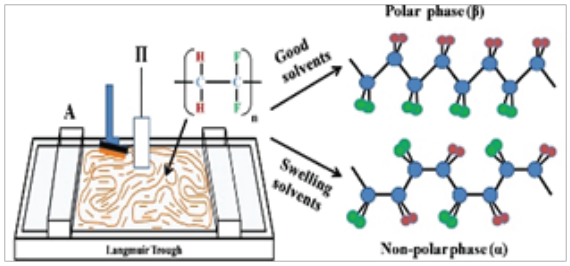
**Investigators:** Nagaiah Kambhala, S. Angappane

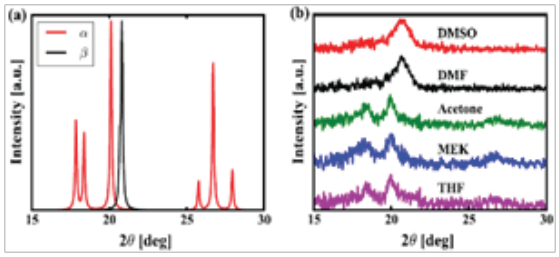
**Collaborators:** S. Shanmukharao Samatham, R. Venkatesh, V. Ganesan, UGC-DAE Consortium for Scientific Research, Indore.

## Impact of good and swelling solvents on the langmuir and langmuir-schaefer films of poly(vinylidene fluoride)

Ultrathin film of poly(vinylidene fluoride), PVDF formed by Langmuir technique using different solvents (good and swelling) as spreading agents show the lift-off area of the polymer and the sign of potential changes with the nature of solvent. Brewster angle microscope show that the textures are largely homogeneous for the good solvents in contrast to swelling agents. Further, multilayers of PVDF were transferred onto silicon substrates using Langmuir-Schaefer method show evidence for a relatively larger fraction of polar β phase formed using good solvents.

*See: European Polymer Journal 86:132-142, 2017.*




**X-ray evidence for polar β phase**

**Investigators:** Chandan Kumar and P. Viswanath

## Langmuir-schaefer multilayer of the blends of amorphous and ferroelectric semi-crystalline polymer

Structural, morphological and wettability of Langmuir-Schaefer multilayer of blends of poly (vinylidene fluoride) and poly (methyl methacrylate) (PMMA) were studied. Xray studies on polymer blends show polar β beta phase presence up to 40% of PMMA. Morphological features drastically Varies with increasing PMMA fraction which impacts the wetting.

*See: European Polymer Journal 96:97-110, 2017*

**Investigators:** Chandan Kumar and P. Viswanath

## Inorganic nanomaterials

New Synthesis routes to obtain films of molybdenum chalcogenides are explored via bottom-up approach. These films could be obtained on any substrate and their applications in electrochemical energy generation and photovoltaics are investigated. The lubrication properties of nano molysulfide and their composites with graphene are also studied. A microwave route for the synthesis of hexagonal MoO3 nanorods of several microns in length has been achieved within 90s in a vertically aligned manner. These could be faithfully converted into the layered polymorph.

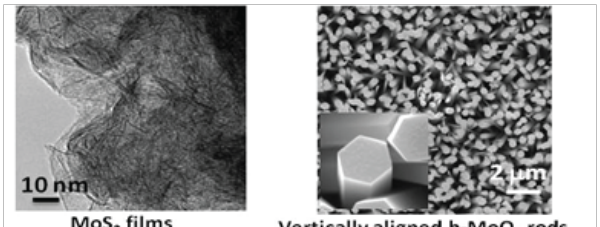
*See: CrystEngComm, 2017,19, 6568.*

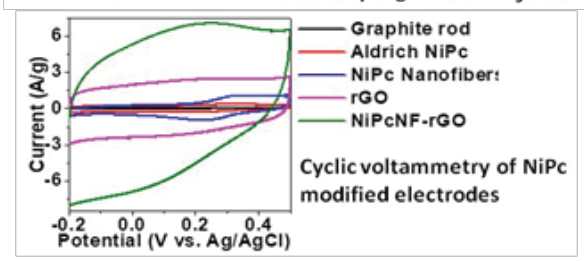
**Investigators:** Vivek Ramakrishnan, Ramya Prabhu, Kaushalendra K Singh, K. Bramhaiah, Neena S John

**Collaborators:** Vidya N Singh, NPL, Delhi; C. Kavitha, BMSIT, Yelahanka

## Electroactive molecular systems

Nanostructures of metallophthalocyanines have been synthesized and they are dispersible in most organic solvents, which otherwise require substituted functional groups for achieving solubility. The dispersions allow facile electrode modifications and higher active area for electrochemical applications.




*See Appl. Surf. Sci., (2017), https://doi.org/10.1016/j.apsusc.2017.12.*

**Investigators:** K. Priya Madhuri and Neena S John

**Collaborators:** Md. Ehesan Ali, INST, Mohali

## Photoelectron spectroscopy of photovoltaic materials

X-ray photoelectron spectroscopy is ideally suited to study the chemical composition, oxidation states and electronic properties of different materials. The use of hard x-ray photoelectron spectroscopy (HAXPES) allow to study of the bulk properties rather than just the outer surface. Both synchrotron and lab based photoelectron spectroscopy are employed to elucidate internal heterostructure and electronic properties of relevant photovoltaic nanomaterials.

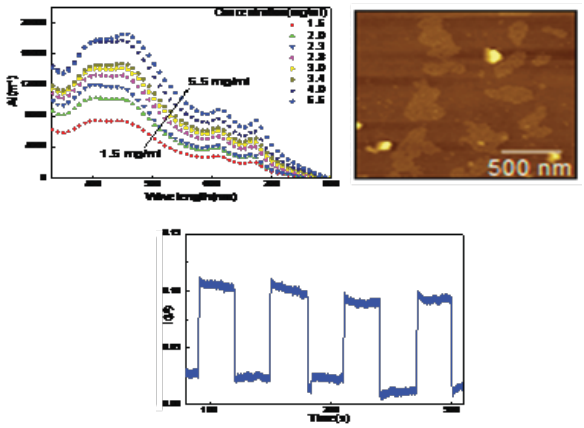
*See J. Phys. Chem. C 2018, 122, 13399; J. Phys. Chem. Lett. 2017, 8, 4988.*

**Investigators:** Anamul Haque and Pralay Santra

**Collaborators:** Vikash Ravi, Angshuman Nag

## Highly concentrated and stable semiconducting inks in low boiling point solvents for printed electronics

Layered materials are gaining interest among the scientific community, owing to their interesting electrical and thermal properties, combined with their mechanical robustness. In this league, transition metal dichalcogenides (TMDC) are an interesting class of semiconducting materials with appealing properties for printed electronics. Among various known synthetic approches, liquid phase exfoliation offers a scalable method for obtaining functional inks for printed electronics. For a good dispersion, the suitability of the solvent is known to be decided by its Hansen solubility parameters (HSP). N-Methyl Pyrrolidone (NMP) is known to be the benchmark among solvents, achieving concentrations as high as 7.5 mg/ml. Despite this, its high boiling point (202$^0$C) posed a challenge to its usage in printing on flexible substrates. In this regard, the need for searching a solvent with a low boiling point and high dispersability still remains unresolved. Inspired by the concept of steric stabilization by surfactants, we invoke the structural aspect of the solvent for exfoliation and stability combined with HSP values. To examine this, two solvents have been chosen with structurally planar and non planar geometry having similar HSP values. As predicted, non planar solvent performed well in exfoliating and stabilizing the MoS2 dispersions compared to the planar solvent. By optimising various parameters, we achieved stable dispersions with concentration of ~5.5 mg/ml in a low boiling point solvent which is highest reported till date. The electron microscopy characterization has revealed that they have sheet like morphology. The obtained dispersions being polydisperse, liquid cascade centrifugation method has been used to enrich the mono- and few-layer $MoS_2$. The semiconducting behaviour of few-layer and monolayer $MoS_2$ has been examined and we also studied its photoresponse at different wavelengths. Preliminary results obtained on spray coating of these inks on substrates like glass and PET, at and just above room temperature point to their potential use in large area printed/flexible electronics.



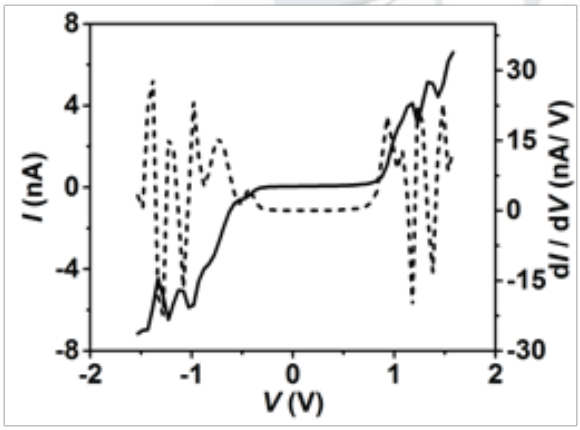

*Indian Patent (filed): 201841014328, 2018*

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

## Negative differential resistance in nickel octabutoxy phthalocyanine/graphene oxide ultrathin films

Negative differential resistance (NDR) has drawn lot of attention for applications like resonant tunneling diode and so on. Studies carried out on ultrathin films of nickel (II) 1,4,8,11,15,18,22,25-octabutoxy-29H,31H-phthalocyanine ($NiPc(OBu)_8$) deposited on highly ordered pyrolytic graphite (HOPG) substrate ($NiPc(OBu)_8$/HOPG) and also on the system, $NiPc(OBu)_8$ on graphene oxide (GO)

deposited on HOPG ($NiPc(OBu)_8$/GO/HOPG) show NDR effect at room temperature. The current-voltage characteristics were carried out using current sensing atomic force microscope (CSAFM) with a platinum (Pt) tip that forms Pt/$NiPc(OBu)_8$/HOPG and Pt/$NiPc(OBu)_8$/GO/HOPG junctions. The CSAFM, UV-visible spectroscopy and cyclic voltammetry studies show that NDR effect occurs due to molecular resonant tunneling. Interestingly, the presence of GO in Pt/$NiPc(OBu)_8$/GO/HOPG junction enhances the features of NDR significantly compared to that of Pt/$NiPc(OBu)_8$//HOPG junction. Also the presence of GO in Pt/$NiPc(OBu)_8$/GO/HOPG junction lowers the voltage corresponding to NDR. This behavior is attributed to the role of GO in injecting holes into the $NiPc(OBu)_8$ film.




*Representative I-V (continuous line) and dI/dV-V (dashed line) characteristics showing NDR effect in Pt/NiPc(OBu)8/GO/HOPG junction.*
*See: Journal of Applied Physics, 2018, 123, 155501-7*

**Investigators:** Arup Sarkar and Kattera A. Suresh

# 6. PUBLICATIONS

**Total no. of Publications :**

| | | |
|---|---|---|
| 1) | In Refereed Journals: | 65 |
| 2) | In conference Proceedings: | 2 |
| 3) | In Books: | 2 |
| | **Average Impact Factor:** | **4.18** |

| Journal | Publications |
|---|---|
| ACS Nano | 1 |
| ACS Appl. Mater. Interfaces | 5 |
| ACS Energy Lett. | 1 |
| Adv. Mater. | 1 |
| ACS Omega | 1 |
| Appl. Surf. Sci. | 1 |
| Carbon | 1 |
| Chem. Asian J. | 1 |
| Chem. Eur.J. | 2 |
| Chem. Mater. | 2 |
| Chem. Select | 3 |
| CrystEngComm | 1 |
| Euro. Poly. J. | 2 |
| J. Am. Chem. Soc | 1 |
| J. Appl. Phys. | 2 |
| J. Chem. Phys. | 2 |
| Journal of Chemical Technology and Biotechnology | 1 |
| J. Mater. Chem. C | 2 |
| J. Mol. Liquids | 6 |
| J. Magn. Magn. Mater | 1 |
| J. Nanosci. Nanotechnol. | 1 |
| J. Nanoparticle Research | 1 |
| J. Phys. Chem. B | 3 |
| J. Phys. Chem. C | 3 |
| J. Phys. Chem. Lett. | 1 |
| J. Phys. Chem. Solids | 1 |
| J. Photochem. Photobiol., A: Chemistry | 1 |
| J. Polym. Sci., Part A: Polym. Chem., | 1 |
| J. Supercond. Nov. Magn | 1 |
| Liq. Cryst. | 2 |
| Mater. Des | 1 |
| Mol. Cryst. Liq. Cryst. | 1 |
| Nano Research | 1 |
| New J. Chem | 1 |
| Phys. Status Solidi B | 2 |
| Sci. Rep. | 1 |
| Small | 1 |
| Soc. Open Sci. | 1 |
| Soft Matter | 1 |
| Sol. Energ Mat. Sol. C | 1 |
| Spectrochim. Acta A | 1 |
| Superlattices Microstruct | 1 |

*Details shown in Annexure A*

# 7. PATENTS

**Total number of Patents: 15**

| No. | Title | Inventors | Patent Application No. |
|---|---|---|---|
| 1. | Textured Glass as hybrid Transparent Conducting Electrode | Shyam Kumar Choudhary, Sumitesh Das, G. U. Kulkarni, Rajashekar N. Pujar | Indian Patent Application No.: IN201721043702 |
| 2. | Compounds exhibiting chiral nematic phase | C.V. Yelamaggad, Govindaswamy Shanker | Indian Patent Application No.: IN201741034439 |
| 3. | Semiconductor junction for photo-generated electrons and method thereof | G.U. Kulkarni, Bharath B, K.D.M. Rao, Harish KN | Indian Patent Application No.: IN201741022128 |
| 4. | A method of enhancement of photoluminescence in a chiral nematic liquid crystal | S. Krishna Prasad, Marlin Baral, Himali Patel, A S Achal Kumar, C V Yelamaggad | Indian Patent Application No.: IN201741020498 |
| 5. | A Nematic Liquid Crystal composite with enhanced photoluminescence and method thereof | Geetha G. Nair, V M Vaisakh, A S Achal Kumar, Balaram Pradhan, C V Yelamaggad | Indian Patent Application No.: IN201741029031 |
| 6. | Chiral Plasmonic Liquid crystalline gold nanoparticles and method thereof | C V Yelamaggad, D S Shankar Rao, S. Krishna Prasad, Geetha G. Nair, Sachin A Bhat | Indian Patent Application No.: IN201841001456 |
| 7. | A method of exfoliation of layered materials and product thereof | H.S.S.R.Matte, Kenneth Lobo, Shivam Trivedi | Indian Patent Application No.: IN201841014328 |
| 8. | A micro supercapacitor and method thereof | G.U.Kulkarni, Suman Kundu, Umesha Mogera | Indian Patent Application No.: IN201841008669 |
| 9. | 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 application is under process. |

# 8. ENTREPRENEURSHIP ACTIVITIES

- CeNS signed a MoU with Hindustan Petroleum Corporation Ltd (HPCL) on 27 February 2017 to find value addition to industrial carbon waste under the "Swachh Bharath" programme.
- A discussion meeting related to the proposed CeNS Technology Business Incubator was held on 13 April 2017. Dr. Santhosh Ansumali, faculty member of JNCASR, and an entrepreneur himself participated in this activity as an external expert.
- Honorable Union Minister for Science & Technology & Earth Sciences Dr. Harsh Vardhan has posted the achievement of the Centre in his tweet dated 3 May 2017.
- A technology-knowhow-transfer agreement was signed with Lab Engineers (India) on 22 May 2017 to manufacture and commercialize a low cost projection lithography system.
- The Centre participated in the India International Science Festival

(IISF)-2017 in the category of "Mega Science, Technology and Industrial Expo" held during 13-16 October 2017 at Chennai. The academic, outreach and R&D activities of CeNS were highlighted at the festival. Centre's capability to transform laboratory research into the technological applications was demonstrated through prototypes.

- An R&D project (funded by DST Nanomission) with Hind High Vaccum Pvt. Ltd., Bengaluru, will manufacture oxide coated metal mesh based transparent conducting plates.
- Under an IGSTC project in collaboration with University of Bayreuth, Papierfabrik Louisenthal and Tata Steel Ltd., the fabrication of metal network on a PET foil by Role to Role process has been accomplished.
- A report on "Smart Hydrogel Windows" developed by Prof. Kulkarni and his group appeared in the 11 November 2017 edition of The Hindu. It said… "Scientists at Bengaluru have developed a smart window that automatically turns from transparent to opaque when heated and also gets back to its original transparent state when the heat is removed. … windows are very cheap costing less than Rs.100 per sq foot. These can be installed to create less energy-consuming buildings…".

*A sample piece of the transparent conductor cut from a roll of crack templated polymer film- based on the invention of Prof. G.U.Kulkarni & his group, at IGSTC project meeting held at Papierfabrik Louisenthal in Gmund am Tegernsee, Germany, April 2018.*

- CeNS participated in the 9th Bengaluru INDIA NANO 2017 held during 7-9 December 2017 at Lalit Ashok, Bengaluru. Prototype devices, based on lab inventions, showcased during the event received high recognition from the industry and academic visitors.
- The Prototype Gallery that houses about fifteen demonstrable prototypes attracts visitors from Industry/Academic institutes on a regular basis. The new prototypes displayed in the Gallery during the year 2017 are:
  - Luminescence based Lead Sensor
  - Transparent EMI shield
  - Detecting the Unseen
  - Instant principle is based on exothermic reaction Hot Packs
  - Breath RHgram

# 9. TEACHING

| No. | Course Title /New Modules | Credits |
|---|---|---|
| 1. | **Basics of Nano and Soft Matter**<br>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 &I I; 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 | **2.1** |
| 2. | **Scientific Communication**<br>How to write research proposals and periodic reports, Ethics in Science, how to make effective oral/poster presentation, Scientific databases & search engines, Means of communicating scientific data, Manuscript preparation, Peer review process, How to write a scientific review. | **1:0** |

| No. | Course Title /New Modules | Credits |
|---|---|---|
| 3. | **Instrumental Methods & Analysis**<br>Electricity, Basic electronics, Data collection & Analysis, Spectroscopic techniques, Vacuum techniques, Thermal analysis, Optical microscopy, Contact angle measurement,Electric and Magnetic measurement techniques, X-ray Diffraction techniques, Electron & Probe microscopy, Science of glas, Machine shop, Rheometry, Raman spectroscopy. | **1:1** |
| 4. | **Intellectual Property**<br>Introduction to intellectual property, Patents, Trade secret and Designs protection, Copyrights, Plant variety protection, Integrated circuit designs, Employing intellectual property rights in revenue generation: methods and challenges | **1:0** |
| 5. | **Safety and Waste Management**<br>Introduction to Personal Protective Equipment (PPE) and significance of their usage, safe working practices, fire fighting techniques, fire safety and drill, chemical/ electrical / high magnetic field /radiation / cryogen safety, general safety and hygiene<br>Waste management problems and objectives, waste segregation, landfills, collection centers, sorting lines, treatment of municipal waste and preventive solutions of waste. | **1:1** |

# 10. EXTRAMURAL RESEARCH PROJECTS

| No. | Project | Duration | Amount Rs. in lakhs |
|---|---|---|---|
| **COMPLETED** | | | |
| 1. | SERB Project titled "Local Conductance, gas sensing and molecular magnetism studies of electroactive systems based on metal phthalocyanines" | 2013-2016 | 23.00 |
| **ONGOING** | | | |
| 1. | IGSTC project on "Nanostructured hybrid transparent network electrodes for large area visibly transparent solar cells (METNETWORK)"<br>*Sanction Order No. IGSTC/Call 2015/METNETWORK/07/2017-18/78 dt. 31.08.2016* | 2016 – 2019 | 185.80 |
| 2. | IUSSTF project titled "Nanomaterials for Clean Energy and Environmental Sensors" *Sanction Order No. IUSSTF/JC-Nanomaterials for Clean Energy and Environmental Sensors/13-2015/2016-17 dt. 11.05.2016* | 2016-2018 | 21.76 |
| 3. | Thematic projects in frontiers of nano S&T (TPF-Nano) on "Chemical Physics of Functional Nanostructures and Interfaces"<br>*Sanction Order No.SR/NM/TP-25/2016 dt. 09.11.2016* | 2016-2019 | 1115.23 |
| 4. | WOS-A project titled "Synthesis of chiral liquid crystals and their composites with nanoparticles: Development of functional mesophases for applied science"<br>*Sanction Order No. SR/WOS-A/CS-134/2016 dt. 22.05.2017* | 2017-2020 | 22.8 |
| 5. | Tata Steel Advanced Materials Research Centre (TSAMRC) | 2016-2021 | 870.00 |
| 6. | CeNS-Centre for High Technology (CHT) Project | 2017-2020 | 100.00 |
| 7. | Nanomission project "Transparent conducting glasses made of metal nanomesh coated with metal oxide overlayer and scaling their production to m2 area"<br>*SR/NM/NT-03/2016(G) dt. 23.08.2017 & SR/NM/NT-03/2016(C) dt. 23.08.2017* | 2016-2019 | 992.67 |
| 8. | SERB Project "Molecular design directed synthesis and characterization of inexpensive, functional organic materials exhibiting technologically relevant liquid crystal phases"<br>*Sanction Order No.EMR/2017/000153 dt. 17.08.2017* | 2017-2020 | 47.70 |
| 9. | SERB Project "Magnetic nanoparticles for memory applications"<br>*Sanction Order No. EMR/2016/005081dt. 24.07.2017* | 2017 – 2020 | 23.44 |

# 11. NEW RESEARCH FACILITIES

- New research facilities and equipments added to the Tata Steel Advanced Materials Research Centre (TSAMRC), Characterization lab (C-Lab), and Devices and Interfaces lab (Di-Lab) are:
- Central glove box integrated with thermal evaporator facility
- Table top sputtering unit
- TGA/DTA
- Contact angle meter with tilting stage.
- Glancing angle deposition system with e-beam gun.
- Upgradation of confocal Raman microscope with additional lasers and variable temperature stage
- Differential Scanning Calorimetry
- Upgradation of FESEM with plasma decontaminator attachment.
- ITO/AZO sputtering system
- High Resolution Transmission Electron Microscope (HRTEM)

*Table top sputtering 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 students on 1st August 2015. Under this programme, in the last academic year, the Centre reached out to nearly 2700 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 academic institutes/schools/colleges and conducted workshops/delivered lectures for the student community. Since its inception in August 2015, more than 7700 students from over 110 schools/colleges have benefitted from this programme.

*Details shown in Annexure B.*

## 12.2. Research Outreach Initiative Studentship (ROIS)

The Research Outreach Initiative Studentship (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 2017-18, twenty four 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: 2 | Submitted: 3 |
|---|---|---|---|
| Sl. No. | Name of the Student | Ph.D | Date |
| 1 | Nagaiah Kambhala | Awarded | May 2017 |
| 2 | Shilpa T. Harish | Awarded | May 2017 |
| 3 | Bramhaiah Kommula | Submitted | June 2017 |
| 4 | P. Srividya | Submitted | September 2017 |
| 5 | S. Vimala | Submitted | December 2017 |

## Ph.D. students (pursuing)

### Senior Research Fellow

| |
|---|
| Mr. Arup Sarkar |
| Ms. Brindhu Malani S. |
| Mr. Chandan Kumar |
| Mr. Indrajit Mondal |
| Mr. Madhu Babu Kanakala |
| Ms. Marlin Baral |
| Ms. Monika .M. |
| Ms. Priya Madhuri K. |
| Mr. Rajashekhar N. Pujar (Project) |
| Ms. Rekha S. Hegde |
| Mr. Sachin Ashok Bhat |
| Mr. Suman Kundu |
| Mr. Sunil Walia |
| Mr. Vaisakh V.M. |
| Mr. Veerabhadraswamy B.N. |

### Research Associates

| |
|---|
| Dr. Vivek Ramakrishnan |
| Dr. Jitendra Kumar |
| Dr. Remya K. Govind |
| Dr. P. Chithaiah |
| Dr. Rajesh Katoch |
| Dr. Sujeet Dutta |
| Dr. Rajasekhar Yerrasani |
| Dr. Rithesh Raj D. |
| Dr. Ram Sevak Singh (Project) |
| Dr. Umesh Mogera (Project) |
| Dr. C. Sathiskumar (Project) |
| Ms. Srividya Parthasarathi (Provisional RA) |
| Mr. Bramhaiah Kommula (Provisional RA - Project) |
| Ms. S.Vimala (Provisional RA) |

### Junior Research Fellow

| |
|---|
| Ms. Athira M. |
| Mr. Alex C. |
| Mr. Amit Bhardwaj |
| Mr. Anamul Haque |
| Mr. Gaurav Shukla |
| Mr. Kenneth Lobo |
| Ms. Pinchu Xavier |
| Ms. Pragnya Satapathy |
| Mr. Prashanth Nayak |
| Ms. Rajalaxmi Sahoo |
| Ms. Ramya Prabhu |
| Ms. Sruthi Rose Tom |
| Mr. Subir Roy |
| Ms. Suchithra P. |
| Mr. Surendra Gopal |
| Ms. Trupthi Devaiah C |
| Ms. Varshini G.V. |

### R&D Assistants

| |
|---|
| Ms. Prasanna M. |
| Mr. Madhanmohanraju |
| Mr. Shivam Trivedi |
| Ms. Sharadhi N. Raj |
| Mr. Keerthan Acharya |
| Ms. Kanaka Deepthi Voora |
| Mr. Ankush Kumar |
| Mr. Mukhesh K.G. |
| Mr. Kaushalendra K. Singh (Project) |
| Ms. Srividya Adiga (Project) |
| Mr. Mukhesh K.G. (Project) |
| Mr. Bikesh Gupta (Project) |

# 14. EVENTS

**CeNS Sports Day** was held on 1 April 2017 on its new campus at Shivanapura. The event was open to all the members of CeNS, their spouse and children.

*CeNS researchers at the running event*

**Bhoomi Pooja** for the construction of laboratories at the CeNS Shivanapura campus was conducted on 19 May 2017. Bharat Ratna Professor C.N.R. Rao, F.R.S., Chairman, Governing Council and dignitaries including the members of Governing Council and Research Advisory Board graced the occasion.

On the occasion of **International Yoga Day,** the Centre arranged a Lecture and demonstration by Shri H.N. Gopalakrishna of Yoga Sannidhi, Bengaluru on 21 June 2017 at CeNS.

*International Yoga Day at CeNS*

**The Gas Sensor Testing Laboratory** was inaugurated by Prof. D. D. Sarma, Chairman, Research Advisory Board on 10 July 2017. The sensing of helium gas by the Pd based gas sensor was demonstrated during the inauguration. Over all, the lab has the potential to control and monitor supply of gases such as $O_2$, H, $N_2$, $CH_4$, CO, NO etc down to ppm level.

During the current academic year seven students joined the Ph.D. programme. **Fresher's Day** was held on 11 August 2017 to welcome the new students.

**Independence Day** was celebrated at the Centre on 15 August 2017 with the National Flag hoisting by the Director. This was followed by a Pledge - *Sankalp to Siddhi* - to commemorate the 75th Anniversary of the Quit India Movement and to build a New India by 2022. A Quiz Program was conducted on the "Quit India Movement" followed by inspiring insights given by a few members on "How India should be in the year 2022".

*Faculty and students pledging "Sankalp to Siddhi"*

The **14th Professor S. Chandrasekhar Memorial Lecture** was delivered on 6 September 2017 by Prof. Ajay K. Sood, FRS, Honorary Professor, Department of Physics, Indian Institute of Science, Bengaluru. The talk titled "Active Matter: Flocking and Bacterial Heat Engine" was attended by among other invited guests, members of the Governing Council and the Research Advisory Board, the family of Prof. Chandrasekhar, faculty and research scholars.

**Swachhta Hi Seva** campaign was held at the Centre during 15 September - 2 October 2017. In this connection a talk on "Urban Solid Waste Management and Emerging Challenges" was delivered by Prof. H. N. Chanakya, Center for Sustainable Technologies, Indian Institute of Science, Bangalore, on 27 September 2017

The Centre observed the **Vigilance Awareness Week** during 30 October to 4 November 2017. The faculty and administrative staff took a pledge on vigilance. As part of the the awareness, the Centre arranged a talk on the aspects relating to vigilance procedures, by Ms. M. Maragathavalli, Senior Audit Officer, Core Faculty - IS & Knowledge Centre, Regional Training Centre - Bengaluru on 3 November 2017

**A special edition of the V4 programme** was held on 7 November 2017 to observe C.V. Raman's birthday. The students and teaching staff from the Little Flower School, Banashankari, Bengaluru participated in the event. The programme included a lecture titled "Small Questions and Big Answers" by Prof. S.M. Shivaprasad, Director, Karnataka State Higher Education Academy, Dharwad and Professor, JNCASR, Bengaluru. The students were also taken on a guided tour of the LiTE Gallery.

**Kannada Rajyotsava** was celebrated at the Centre on 24 November 2017. Several programmes including Kannada songs rendition, essay competition, music, skit, quiz etc. were conducted during the event.

CeNS celebrated **National Science Day** on 28 February 2018 based on the theme "Science and Technology for a Sustainable Future". As part of this, two talks titled "Imagine life without science" and "Spintronics" were delivered by Prof. Ashok K. Ganguli, Department of Chemistry, Indian Institute of Technology, New Delhi and Prof. P.S.Anil Kumar, Indian Institute of Science, Bengaluru, respectively.

*Prof. P.S.Anil Kumar, from Indian Institute of Science, Bengaluru, interacting with the young students from BEL High School on National Science Day*

# 15. HONOURS & AWARDS

## 15.1. AWARD

**Dr. Neena S John** recieved the Springer award for best paper at the 'International Conference for NextGen Technologies: Silicon to Software' organized at VIT University, Chennai, in March 2017

**Prof. G. U. Kulkarni** received Prof. C.N.R. Rao Science award at the 13th Kannada Science Conference held on19 September 2017.

**Bharat Ratna Professor C.N.R. Rao, F.R.S.,** Chairman of the Governing Council, received the highly prestigious **Von Hippel Award** for materials research. The citation reads "…for his immense interdisciplinary contributions to the development of novel functional materials, including nanomaterials, graphene, superconductivity, 2D materials and colossal magnetoresistance". The award was presented to Prof. Rao at the MRS meeting held in Boston on 29 November 2017.

CeNS was bestowed with "Best Exhibit Award for the Year 2017" in the category of Innovative Display at the 9th Bengaluru INDIA NANO 2017, 7-9, December 2017, Bengaluru.

## 15.2. HONOURS

**G. U. Kulkarni**

- Adjunct Member of the faculty for Science and Technology, Gulbarga University, Gulbarga
- Chief Editor of Bulletin of Materials Science, Indian Academy of Sciences, Bangalore

**S. Krishna Prasad**

- Associate Editor for Bulletin of Materials Science, Indian Academy of Sciences, Bangalore

**Neena S. John**

• Member of the Royal society of Chemistry, London, UK

**K.A. Suresh**

• Adjunct Professor, Department of Materials Science, Mangalore University, Mangaluru

### 15.3. POSTER AWARDS

• Sunil Walia, SRF, won "Best Poster Award" at the IUSSTF Workshop, 11 & 13 March 2017.

• Marlin Baral, SRF, won "Best Poster Award" for "CNT-reinforced polymer stabilized LCD", CeNS-Manipal University Joint Workshop 2017, 27-28 June 2017

• Marlin Baral, SRF, won "Best oral presentation" award for "Carbon nanotube reinforcement caused thermally invariant operating voltage and accelerated dynamics in a polymer stabilized liquid crystal device", CeNS-INST Joint Symposium 2017, 16-17 November 2017

• Brindhu Malani S, SRF, won Poster award for "Colloidal monolayer lithography" at CeNS-INST Joint Symposium, Hospet, 16-17 November 2017.

• Sunil Walia was conferred with the prestigious "Karnataka DST Nanoscience Fellowship" award instituted by the Dept of S & T, Govt of Karnataka, for his poster titled "Transparent Faraday Cage", at the 9th Bengaluru INDIA NANO 2017, 7-9, December 2017, Bengaluru.

• Vaisak, V. M., won "Best Poster Award" for his poster titled "Enhanced photoluminescence in anisotropic magnetogel" at the 9th Bengaluru INDIA NANO 2017, 7-9, December 2017, Bengaluru.

• Brindhu Malani S, SRF, won "Best Poster Award" for "Hydrophobic-hydrophilic patterned surfaces with selective wettability" at CompFlu 2017, IITM, 18-20 December 17.

• Pragnya Satapathy, JRF, got "Best Poster Award" from Springer for "Direction dependent photoluminescence blocking in liquid crystals using ZnO-Ag nanohybrids", ICONSAT 2018, 21-23 March 2018

• Indrajit Mondal, JRF, got "Best Poster Award" for "Large Area Smart Windows for Indoor Light and Heat Modulation", ICONSAT 2018, 21-23 March 2018

• Umesha Mogera, PDF, got "ACS Poster Award" for "Decoupled Graphene Multilayers and its Extraordinary Properties", ICONSAT 2018, 21-23 March 2018

# 16. RESERVATION

The Centre follows the national policies on Reservation and Official Language 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 Day

On the occasion of Hindi Pakhwada, several programmes were conducted during 14-29 September 2017. The programme consisted of quiz in Hindi, instant Hindi sentence formation, writing Hindi words for Non-Hindi speaking staff etc. Also a general talk on Rajbhasha Hindi was given by Shri Rajendra Kumar Sharma, Assistant Director-in-Charge, Hindi Teaching Scheme, Bengaluru, was held on the occasion.

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

# 18. AUDITED STATEMENT OF ACCOUNTS

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

## AUDITOR'S REPORT

## TO THE MEMBERS OF THE GOVERNING BODY OF CENTRE FOR NANO AND SOFT MATTER SCIENCES, BENGALURU

### Report on the Financial Statements

We have audited the financial statements of **"Centre for Nano and Soft Matter Sciences"** Prof. U.R Rao Road, Jalahalli, Bengaluru 560 013, which comprise the Balance Sheet as at 31st March 2018 and the Statement of Income & Expenditure Account for the year then ended and the Receipts and Payments for the year then ended and a summary of significant accounting policies and other explanatory information.

### Management's Responsibility for the Financial Statements

Management is responsible for the preparation of the financial statements. This responsibility includes the design, implementation and maintenance of internal control relevant to the preparation of the financial statements that are free from material misstatement, whether due to fraud or error.

### Auditor's Responsibility

Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with the Standards on Auditing issued by the Institute of Chartered Accountants of India. Those Standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances. An audit also includes evaluating the appropriateness of the accounting policies used and the reasonableness of the accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion on the financial statement.

No 37/1, 1st Floor, M.N.K. Rao Road
Basavanagudi, Bangalore - 560 004
Phone: 080 - 26566448, 26577448

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

**Opinion**

In our opinion and to the best of our information and according to the explanations given to us, the said accounts give the information required & give a true and fair view in conformity with the accounting principles in India.

1) In the case of the Balance Sheet, of the state of affairs of **Centre for Nano and Soft Matter Sciences**, as at 31st March 2018.

2) In the case of Income & Expenditure Account, of the Excess of Expenditure over Income for the year ended on that date.

We further report that:

a) The Balance Sheet & Income & Expenditure Account dealt with by this report, are in agreement with the books of Accounts.

b) In our opinion, proper books of accounts as required 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 prepared in accordance with the Accounting Standards issued by the Institute of Chartered Accountants of India subject to the following observation:

Non-Provision of accrued liability in respect of Gratuity and leave encashment which is not in conformity with the Accounting Standard - 15 (Accounting for retirement benefits) issued by the Institute of Chartered Accountants of India.

For B R V GOUD & CO.,
Chartered Accountants
F R N. 000992S

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

Place: Bangalore
Date: 25.07.2018

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

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

## BALANCE SHEET AS AT 31ST MARCH, 2018

(Amount in Rs.)

| I. CORPUS / CAPITAL FUND AND LIABILITIES | SCH | 31.03.2018 | 31.03.2017 |
|---|---|---|---|
| CORPUS / CAPITAL FUND | 1 | 25,92,58,834 | 25,07,67,194 |
| RESERVES AND SURPLUS | 2 | - | - |
| EARMARKED PROJECTS FUNDS | 3 | 16,62,94,624 | 5,10,22,130 |
| SECURED LOANS AND BORROWINGS | 4 | - | - |
| UNSECURED LOANS AND BORROWINGS | 5 | - | - |
| DEFERRED CREDIT LIABILITIES | 6 | - | - |
| CURRENT LIABILITIES AND PROVISIONS | 7 | 2,44,42,943 | 1,05,68,012 |
| **TOTAL** | | **44,99,96,401** | **31,23,57,336** |
| **II. APPLICATION OF FUNDS/ASSETS** | | | |
| FIXED ASSETS | 8 | 18,74,67,242 | 14,00,81,780 |
| INVESTMENTS - FROM EARMARKED/ENDOWMENT FUNDS | 9 | - | - |
| INVESTMENTS - OTHERS | 10 | - | - |
| CURRENT ASSETS, LOANS, ADVANCES ETC., | 11 | 26,25,29,159 | 17,22,75,556 |
| **TOTAL** | | **44,99,96,401** | **31,23,57,336** |
| **SIGNIFICANT ACCOUNTING POLICIES AND NOTES ON ACCOUNTS** | 24 | | |

(VIVEK DUBEY)
ACCOUNTS OFFICER

(SUBHOD M GULVADY)
ADMINISTRATIVE 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 :BANGALORE
DATE :25-7-18

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

## INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2018

(Amount in Rs.)

| A - INCOME | SCH | 2017-18 | 2016-17 |
|---|---|---|---|
| Income from Sales / Services | 12 | - | - |
| Grants / Subsidies: | 13 | 8,61,99,000 | 7,72,70,000 |
| Fees / Subscriptions | 14 | - | - |
| Income from Investments(income on investments from earmarked / endowment Funds) | 15 | - | - |
| Income from Royalty, Publications etc., | 16 | - | - |
| Interest earned | 17 | 72,57,149 | 83,16,528 |
| Other Income | 18 | 74,60,981 | 10,86,642 |
| Increase / (decrease) in stock of finished goods and work-in-progress | 19 | - | - |
| **TOTAL (A)** | | **10,09,17,130** | **8,66,73,170** |
| **B - EXPENDITURE** | | | |
| Establishment Expenses | 20 | 4,37,84,317 | 4,02,11,407 |
| Other Administrative Expenses etc., | 21 | 4,87,86,654 | 2,75,53,162 |
| Expenditures on Grants, Subsidies etc., | 22 | - | - |
| Interest | 23 | - | - |
| **TOTAL (B)** | | **9,25,70,971** | **6,77,64,569** |
| **C - BALANCE BEING SURPLUS / (DEFICIT) (A-B)** | | 83,46,159 | 1,89,08,601 |
| **D** - Depreciation for the year | | (2,10,26,130) | (2,10,87,349) |
| Prior period adjustment | | (4,92,389) | - |
| **E. SURPLUS / (DEFICIT) CARRIED TO CORPUS / CAPITAL FUND ( C-D )** | | (1,31,72,360) | (21,78,748) |
| **SIGNIFICANT ACCOUNTING POLICIES AND NOTES ON ACCOUNTS** | 24 | | |

(VIVEK DUBEY)
ACCOUNTS OFFICER

(SUBHOD M GULVADY)
ADMINISTRATIVE 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: BANGALORE
DATE : 25.7.18

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

## RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 31ST MARCH, 2018

(Amount in Rs.)

| RECEIPTS | 2017-18 | 2016-17 | PAYMENTS | 2017-18 | 2016-17 |
|---|---|---|---|---|---|
| **I Opening Balances** | | | **I. Establishment Expenses** | 4,21,61,400 | 3,67,50,838 |
| **1) Cash in Hand** | - | 6,825 | | | |
| **2) Bank Balances** | | | **II Administrative Expenses** | 3,68,76,833 | 2,85,06,261 |
| a) State Bank of India A/c No.274 | 1,50,57,184 | 2,65,27,202 | | | |
| b) State Bank of India A/c No.219 | 4,19,36,037 | 50,00,000 | **III Fixed Assets (Additions)** | 4,34,55,221 | 1,38,22,202 |
| c) State Bank of Mysore A/c No.430 | 16,66,801 | 5,17,184 | | | |
| d) State Bank of India A/c No.408 | - | 3,825 | **IV A) Remittances/Refunds etc.,** | | |
| | | | a) Earnest Money Deposit & Security Deposit & S Creditors | 25,86,597 | 2,48,18,231 |
| **II Grants-in-aid from DST, Govt of India** | 16,16,87,000 | 9,22,76,000 | | | |
| | | | **B) Remittances/Refunds etc.,** | | |
| **III Interest Received** | | | a) C.P.F. Employees Contribution | 12,87,115 | 7,08,462 |
| a) On SB Accounts and Auto Sweep | 46,07,539 | 26,24,388 | b) C.P.F. CeNS Contribution | 4,29,614 | 4,26,950 |
| b) On Fixed/Term Deposits | 35,87,867 | 26,35,485 | c) Income Tax Deducted at source from staff, contractor & rent and Professional Tax | 45,71,538 | 37,69,938 |
| **IV Other Income** | | | | | |
| a) Sample Charges | 6,84,500 | 2,52,500 | d) Advance to suppliers/others etc., | 41,32,196 | 35,55,129 |
| b) Miscellaneous Receipts | 9,55,281 | 3,03,824 | e) Staff Advances | 15,07,412 | 17,83,013 |
| | | | f) New Pension Scheme Tier 1 | 7,18,836 | 6,72,736 |
| **V Other Recoveries etc.,** | | | g) NPS CENS Contribution | 6,58,673 | |
| **A)** Earnest Money Deposit & Security Deposit & S. Creditors | 41,50,048 | 26,72,718 | h) TDS by Bank and others | 4,08,221 | 85,120 |
| | | | i) Provisions for last year paid | 65,51,055 | 25,70,593 |
| **B)** i) CPF Employees Contribution | 11,92,414 | 11,35,412 | j) Other Deductions | 2,55,727 | - |
| ii) Income Tax Deducted at source from staff, contractor & rent and Professional Tax | 44,16,864 | 37,33,200 | | | |
| | | | **VI Investments** | | |
| iii) Advance to suppliers/others etc., | 3,67,235 | 7,74,776 | Fixed/Term Deposits and Margin Money | 5,08,01,848 | 4,29,22,912 |
| iv) Staff Advance Recovery | 12,77,082 | 18,44,034 | | | |
| v) New Pension Scheme Tier -1 | 6,46,410 | 6,87,832 | **VII Earmarked Project Expenses** | 3,17,86,720 | 81,17,707 |
| vi) Other Deductions | 4,00,766 | | | | |
| | | | **VIII Conference Expenses** | 12,44,714 | - |
| **C)** i) Establishment Receipts | 24,755 | 4,25,346 | | | |
| ii) Other Administrative Receipts | 9,47,653 | 7,27,024 | **IX Closing Balance** | | - |
| | | | **1) Cash in Hand** | | |
| **VI Deposit with Bank** | | | **2) Bank Balances** | | |
| a) Fixed/Term deposits matured | - | 4,03,10,951 | a) State Bank of India A/c No.274 | 5,08,97,618 | 1,50,57,184 |
| | | | b) State Bank of India A/c No.219 | 8,97,40,438 | 4,19,36,037 |
| **VII Grants/Financial Assistances received for Earmarked Projects** | 12,72,10,789 | 4,47,11,588 | c) State Bank of India A/c No.430 | 19,49,118 | 16,66,801 |
| | | | d) State Bank of India A/c No.676 | 37,43,762 | - |
| **VIII Conference Receipts** | | | | | |
| a) Registration Fee and Sponsorship | 49,48,431 | | | | |
| **TOTAL** | **37,57,64,656** | **22,71,70,114** | **TOTAL** | **37,57,64,656** | **22,71,70,114** |

(VIVEK DUBEY)
ACCOUNTS OFFICER

(SUBHOD M GULVADY)
ADMINISTRATIVE 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 :BANGALORE
DATE 25-7-18

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

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2018

(Amount in Rs.)

| Particulars | As at 31.03.2018 | As at 31.03.2017 |
|---|---|---|
| **SCHEDULE 1** | | |
| **A. CAPITAL FUND:** | | |
| As Per Previous Balance Sheet | 25,07,67,194 | 18,41,15,942 |
| **ADD:** Capital Grants received: | | |
| Campus Development | - | 4,00,00,000 |
| Capital Assets | 2,16,64,000 | 2,88,30,000 |
| | 27,24,31,194 | 25,29,45,942 |
| **ADD/(LESS):** Surplus / (Deficit) for the year | (1,31,72,360) | (21,78,748) |
| **TOTAL** | **25,92,58,834** | **25,07,67,194** |
| **SCHEDULE 2 - RESERVES AND SURPLUS:** | - | - |
| **SCHEDULE 3 - EARMARKED / PROJECT FUNDS:** | **16,62,94,624** | **5,10,22,130** |
| (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 | 11,38,049 | 6,05,662 |
| 2) Other Liabilities | 32,91,663 | 33,30,878 |
| 3) Stale Cheque | 62,620 | 62,620 |
| **TOTAL (A)** | **44,92,332** | **39,99,160** |
| B) **PROVISIONS:** | | |
| Salaries and Services and Supplies | 1,99,50,611 | 65,68,852 |
| **TOTAL (B)** | **1,99,50,611** | **65,68,852** |
| **TOTAL (A+B)** | **2,44,42,943** | **1,05,68,012** |
| **SCHEDULE 8 - FIXED ASSETS** | **18,74,67,242** | **14,00,81,780** |
| **SCHEDULE 9- INVESTMENTS FROM EARMARKED / ENDOWMENT FUNDS:** | - | - |
| **SCHEDULE I0 - INVESTMENTS - OTHERS:** | - | - |
| **SCHEDULE 11 - CURRENT ASSETS,LOANS, ADVANCES:** | | |
| **A) CURRENT ASSETS:** | | |
| 1) Inventories | - | - |
| 2) Sundry Debtors: | - | - |
| 3) Cash Balances in Hand | - | - |
| 4) Bank Balances:- Nationalised Banks | | |
| a. Term Deposit Receipts (includes margin money) | 10,82,07,354 | 5,68,39,732 |
| c. Savings Accounts: | | |
| SBI SB A/c No.274 | 5,27,38,846 | 1,50,57,184 |
| SBI SB Project A/c 219 | 8,97,40,438 | 4,19,36,037 |
| SBI SB A/c 24430 | 1,07,890 | 16,66,801 |
| SBI SB A/c 75676 | 37,43,762 | - |
| **TOTAL (A)** | **25,45,38,290** | **11,54,99,754** |

| Particulars | As at 31.03.2018 | As at 31.03.2017 |
|---|---|---|
| **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: | 16,22,444 | 32,621 |
| K P T C L Deposit (SERC/CLCR) | 3,62,590 | 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 | | 5,38,24,000 |
| 5) Accrued Interest & Prepaid Exp.(Insurance) | 49,63,300 | 19,20,606 |
| 4) TDS By Bank/ BESCOM & Others | 5,72,845 | 1,66,295 |
| **TOTAL (B)** | **79,90,869** | **5,67,75,802** |
| **TOTAL (A+B)** | **26,25,29,159** | **17,22,75,556** |
| **SCHEDULE 12 - INCOME FROM SALES / SERVICES:** | - | - |
| **SCHEDULE 13 - GRANTS / SUBSIDIES:** | | |
| Grant in Aid -Salaries | 4,64,22,000 | 4,28,51,000 |
| Grant in Aid -Salaries (SC ) | 19,22,000 | 19,22,000 |
| Grant in Aid -General | 3,23,55,000 | 3,24,97,000 |
| Grant in Aid -ICONSAT | 45,00,000 | - |
| Grant in Aid -Nano for youth | 7,50,000 | - |
| Grant in Aid -Young Career Award | 2,50,000 | - |
| **TOTAL** | **8,61,99,000** | **7,72,70,000** |
| **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 | 47,75,412 | 61,18,121 |
| 2) On Savings Accounts - Nationalised Bank | 24,81,737 | 21,98,407 |
| **TOTAL** | **72,57,149** | **83,16,528** |
| **SCHEDULE 18 - OTHER INCOME:** | | |
| Sample charges | 6,81,800 | 2,52,500 |
| Miscellaneous Income | 10,14,606 | 8,34,142 |
| Project Administration | 8,30,000 | - |
| Bhutan Conference | 31,924 | - |
| ICONSAT - 2018 | 49,02,651 | - |
| **TOTAL** | **74,60,981** | **10,86,642** |
| **SCHEDULE 19 - INCREASE (DECREASE) IN STOCK OF FINISHED GOODS & WORK IN PROGRESS:** | - | - |
| **SCHEDULE 20 - ESTABLISHMENT EXPENSES:** | | |
| 1) Salaries, Allowance and Wages to Staff | 3,48,71,495 | 3,13,10,956 |
| 2) Medical Expenses Reimbursed | 36,204 | 1,20,073 |
| 3) Fellowship & Book Grant | 83,86,876 | 82,82,732 |
| 4) Salary -SC | 4,89,742 | 4,97,646 |
| **TOTAL** | **4,37,84,317** | **4,02,11,407** |

| Particulars | As at 31.03.2018 | As at 31.03.2017 |
|---|---|---|
| **SCHEDULE 21 - OTHER ADMINISTRATIVE EXPENSES,ETC:** | | |
| Auditors Remuneration | 41,300 | 57,500 |
| Chemicals, Glasswares & Consumables etc., | 20,55,701 | 17,57,211 |
| Duties & Taxes | 3,49,927 | 45,738 |
| Electricity & Water Charges | 32,84,237 | 33,15,650 |
| Fees & Professional charges | 8,12,070 | 6,86,054 |
| Fuel Charges for Genset | 1,78,938 | 1,59,000 |
| Hospitality Charges | 3,17,655 | 6,63,881 |
| House Keeping Charges | 26,27,263 | 15,32,528 |
| Journals & Periodicals /Books | 5,19,596 | 4,40,189 |
| Reimbursement of Fees to Students | 1,34,802 | 2,53,075 |
| Conveyance/ Transportation Charges | 19,80,058 | 19,24,222 |
| Man Power Supply Expenses | 53,04,307 | 21,51,707 |
| Other Miscellaneous Charges / Bank Charges | 1,36,276 | 1,35,752 |
| Advertisement and Publicity Charges | 1,48,106 | 1,59,567 |
| Printing & Stationery | 7,87,121 | 9,95,333 |
| Registration & Renewals | 2,46,725 | 1,52,100 |
| Rent & Insurance | 47,05,262 | 38,05,514 |
| Repairs & Maintenance | 57,60,390 | 41,41,951 |
| Security Charges | 32,36,077 | 18,82,221 |
| Seminars and Conferences | 21,55,167 | 3,22,692 |
| Telephone & Postage | 7,76,651 | 8,08,656 |
| Travel Expenses | 14,64,006 | 17,72,921 |
| Testing (N.M.R.) & Sample analysis charges | 17,461 | 1,11,550 |
| IP Related Expenses | 7,44,608 | 2,78,150 |
| Project Administration | 8,30,000 | |
| Young Career Awards | 2,85,799 | - |
| ICONSAT 2018 | 93,11,131 | - |
| Nano for Youth | 5,76,020 | - |
| **TOTAL** | **4,87,86,654** | **2,75,53,162** |
| **SCHEDULE 22 - EXPENDITURE ON GRANTS, SUBSIDIES ETC:** | - | - |
| **SCHEDULE 23 - INTEREST:** | - | - |

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

**SCHEDULE 3 - EARMARKED / PROJECTS**

**Annexure - A to Schedule 3**

(Amount in Rs.)

| Particulars | Government and Governmental bodies Sponsored Projects | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Balance Under Closed Project | DST/TPF/ GUK / 05/16-19 | DST/NMNT/ GUK/06/2017-19 | IGSTC/GUK/03/16-19 | IUSSTF/GUK /02/16-18 | Inspire Fellowship | Nano Mission School | National Post Doctrol Fellowship | SERB/EMA/ SANG/01/2017-20 | SERB/EMR/ CVY/01/2017 20 | WOS-A/CS134/USH/01/2017-20 | Project Administr - ation | Total Under Government Project |
| a) Opening Balance of the Funds | 57,60,327 | 1,73,19,099 | - | 66,48,032 | 8,55,891 | 1,46,855 | - | - | - | - | - | 17,80,000 | 3,25,10,204 |
| b) Additions to the Funds: | | | | | | | | | | | | | |
| i) Grants or Other receipts | 16,36,896 | 8,00,00,000 | 3,56,36,120 | 15,03,272 | - | 15,74,000 | 8,50,000 | 17,04,461 | 10,17,077 | 29,22,000 | 8,88,500 | 9,50,500 | 12,86,82,826 |
| ii) Income from investment made | - | 22,05,489 | 12,65,982 | 2,68,201 | 32,358 | 40 | - | 46,133 | 33,635 | 1,02,414 | 34,559 | 1,13,081 | 41,01,892 |
| iii) Other Receipts | | | | | | | | | | | | | |
| iii) Trfrd. during the year | | | | | | | | | | | | | |
| **TOTAL (a+b)** | **73,97,223** | **9,95,24,588** | **3,69,02,102** | **84,19,505** | **8,88,249** | **17,20,895** | **8,50,000** | **17,50,594** | **10,50,712** | **30,24,414** | **9,23,059** | **28,43,581** | **16,52,94,922** |
| c) Utilisation/Expenditure towards objectives of Funds: | | | | | | | | | | | | | |
| i) Capital Expenditure | | | | | | | | | | | | | |
| Fixed Assets | | | | | | | | | | | | - | - |
| Others | | | | | | | | | | | | - | - |
| ii) Revenue Expenditure | | | | | | | | | | | | | - |
| Salaries, Wages and Allowances etc., | | | 8,95,188 | 8,27,576 | | 18,68,452 | | 8,69,354 | | | 55,000 | - | 45,15,570 |
| Consumables/ travel | | 16,21,003 | 6,09,717 | 7,20,698 | 37,050 | | 10,41,693 | | 94,689 | 1,79,482 | | - | 43,04,332 |
| Depreciation | 9,29,879 | 33,098 | - | 1,687 | | | | | 29,207 | 1,48,390 | | - | 11,42,261 |
| Overheads | 2,00,000 | | | | | | | | | | | | 2,00,000 |
| Grant Refunded | | | | | | | | | | | | - | - |
| **TOTAL (c)** | **11,29,879** | **16,54,101** | **15,04,905** | **15,49,961** | **37,050** | **18,68,452** | **10,41,693** | **8,69,354** | **1,23,896** | **3,27,872** | **55,000** | - | **1,01,62,163** |
| **NET BALANCE AT THE YEAR END (a+b-c)** | **62,67,344** | **9,78,70,487** | **3,53,97,197** | **68,69,544** | **8,51,199** | **(1,47,557)** | **(1,91,693)** | **8,81,240** | **9,26,816** | **26,96,542** | **8,68,059** | **28,43,581** | **15,51,32,759** |

....2

**Annexure - A to Schedule 3**

(Amount in Rs.)

| FUNDS | Industries Sponsor Project/ Joint Venture with Industries | | | Total of Projects | | | |
|---|---|---|---|---|---|---|---|
| | 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 | 1,56,99,065 | 18,64,417 | 9,48,444 | 1,85,11,926 | 3,25,10,204 | 5,10,22,130 | 1,16,79,029 |
| b) Additions to the Funds: | | | | | | | |
| i) Grants | | | | | 12,84,82,826 | 12,84,82,826 | 4,62,79,260 |
| ii) Income from investment made | 3,55,103 | 57,971 | 22,236 | 4,35,310 | 41,01,892 | 45,37,202 | 3,94,698 |
| **TOTAL (a+b)** | **1,60,54,168** | **19,22,388** | **9,70,680** | **1,89,47,236** | **16,50,94,922** | **18,40,42,158** | **5,83,52,987** |
| c) Utilisation/Expenditure towards objectives of Funds: | | | | | | | |
| Rental and Maintenance Charges | 10,83,506 | | | 10,83,506 | - | 10,83,506 | 2,68,600 |
| Project Cost | 37,42,819 | | | 37,42,819 | - | 37,42,819 | 8,89,992 |
| Other Expenditure as per project | | 7,85,786 | | 7,85,786 | - | 7,85,786 | 15,28,294 |
| Salaries, Wages and Allowances etc., | | | 5,51,193 | 5,51,193 | 45,15,570 | 50,66,763 | 13,82,450 |
| Consumables/ travel | | | 3,51,387 | 3,51,387 | 43,04,332 | 46,55,719 | 8,49,440 |
| Depreciation | 10,54,616 | | | 10,54,616 | 11,42,261 | 21,96,877 | 11,56,095 |
| Overheads | | | 2,16,064 | 2,16,064 | - | 2,16,064 | 11,67,175 |
| Grant Refunded | - | - | - | - | - | - | 88,811 |
| **TOTAL (c)** | **58,80,941** | **7,85,786** | **11,18,644** | **77,85,371** | **99,62,163** | **1,77,47,534** | **73,30,857** |
| **NET BALANCE AT THE YEAR END (a+b-c)** | **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** |

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 01.04.2017 | Additions during the year | | | Total as on 31.03.2018 | Rate of Dep. | Depreciation Full Rate | Dep. For Addition <180 Days | Total Depreciation for the year | W.D.V. as on 31.03.2018 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | >180 days | <180 Days | Total additions | | | | | | |
| CIVIL WORKS | | | | | | | | | | |
| Aluminium Partitions | 16,83,554 | - | 1,70,151 | 1,70,151 | 18,53,705 | 10 | 1,68,355 | 8,508 | 1,76,863 | 16,76,842 |
| Brick Base(Partitions) | 80,463 | - | - | - | 80,463 | 10 | 8,046 | - | 8,046 | 72,417 |
| Construction of Cycle Stand | 31,747 | - | - | - | 31,747 | 10 | 3,175 | - | 3,175 | 28,572 |
| Construction of Shed | 32,717 | - | - | - | 32,717 | 10 | 3,272 | - | 3,272 | 29,445 |
| Vinyl Flooring | 1,56,572 | - | - | - | 1,56,572 | 10 | 15,657 | - | 15,657 | 1,40,915 |
| Other Miscellaneous Works | 24,97,479 | | | - | 24,97,479 | 10 | 2,49,748 | - | 2,49,748 | 22,47,731 |
| New Campus (WIP) | 68,47,429 | 24,14,226 | 69,26,170 | 93,40,396 | 1,61,87,825 | - | - | - | - | 1,61,87,825 |
| Infrastructure | - | - | 1,98,81,776 | 1,98,81,776 | 1,98,81,776 | - | - | - | - | 1,98,81,776 |
| BUILDING (Main & Annexe) | 44,79,007 | 3,13,000 | 7,43,372 | 10,56,372 | 55,35,379 | 10 | 4,79,201 | 37,169 | 5,16,370 | 50,19,009 |
| ELECTRICAL INSTALLATIONS | | | | | | | | | | |
| Air Conditioner | 9,69,692 | | 81,650 | 81,650 | 10,51,342 | 15 | 1,45,454 | 6,124 | 1,51,578 | 8,99,764 |
| Computers | 9,10,737 | 4,47,047 | 6,77,103 | 11,24,150 | 20,34,887 | 60 | 8,14,670 | 2,03,131 | 10,17,801 | 10,17,086 |
| Fume Cupboard | 1,07,513 | | | - | 1,07,513 | 10 | 10,751 | - | 10,751 | 96,762 |
| Electrical Installation | 6,68,807 | | 7,03,770 | 7,03,770 | 13,72,577 | 10 | 66,881 | 35,189 | 1,02,070 | 12,70,507 |
| Generator Set | 3,16,875 | | | - | 3,16,875 | 15 | 47,531 | - | 47,531 | 2,69,344 |
| FURNITURE & FIXTURES | | | | | | | | | | |
| Carpentry Works | 3,62,422 | | | - | 3,62,422 | 10 | 36,242 | - | 36,242 | 3,26,180 |
| Furniture & Fixtures | 36,75,563 | 7,49,105 | 11,94,113 | 19,43,218 | 56,18,781 | 10 | 4,42,467 | 59,706 | 5,02,173 | 51,16,608 |
| GENERAL EQUIPMENTS | | | | | - | | | | | |
| Canteen Vessels and Equipments | 1,31,492 | 18,499 | 63,322 | 81,821 | 2,13,313 | 15 | 22,499 | 4,749 | 27,248 | 1,86,065 |
| Equipment | 63,78,034 | 18,25,715 | 2,57,958 | 20,83,673 | 84,61,707 | 15 | 12,30,562 | 19,347 | 12,49,909 | 72,11,798 |
| Workshop & Other Equipments | 1,52,829 | | 8,850 | 8,850 | 1,61,679 | 15 | 22,924 | 664 | 23,588 | 1,38,091 |
| SCIENTIFIC EQUIPMENTS | 10,40,47,645 | 47,23,716 | 75,78,717 | 1,23,02,433 | 11,63,50,078 | 15 | 1,63,15,704 | 5,68,404 | 1,68,84,108 | 9,94,65,970 |
| **Total - (A)** | **13,35,30,577** | **1,04,91,308** | **3,82,86,952** | **4,87,78,260** | **18,23,08,837** | | **2,00,83,139** | **9,42,991** | **2,10,26,130** | **16,12,82,707** |

**B. PROJECTS**

(Amount in Rs.)

| DESCRIPTION | W.D.V. as on 01.04.2017 | Additions during the year | | | Total as on 31.03.2018 | Rate of Dep. | Depreciation Full Rate | Dep. For Addition <180 Days | Total Depreciation for the year | W.D.V. as on 31.03.2018 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | >180 days | <180 Days | Total additions | | | | | | |
| **I. Assets Under Closed Projects** | 61,99,193 | - | - | - | 61,99,193 | 15 | 9,29,879 | - | 9,29,879 | 52,69,314 |
| **II. DST/TPF/ GUK / 05/16-19** | | | | | | | | | | |
| Equipment | - | 2,06,927 | 27,450 | 2,34,377 | 2,34,377 | 15 | 31,039 | 2,059 | 33,098 | 2,01,279 |
| **II. IGSTC/GUK/03/16-19** | | | | | | | | | | |
| Equipment | - | - | 22,497 | 22,497 | 22,497 | 15 | - | 1,687 | 1,687 | 20,810 |
| **III. DST/NMNT/GUK/06/2017-19** | | | | | | | | | | |
| Equipment (WIP) | - | - | 1,08,16,599 | 1,08,16,599 | 1,08,16,599 | 15 | - | - | - | 1,08,16,599 |
| **IV. SERB/EMA/SANG/01/2017-20** | | | | | | | | | | |
| Equipment | - | - | 3,89,430 | 3,89,430 | 3,89,430 | 15 | - | 29,207 | 29,207 | 3,60,223 |
| **V. SERB/EMR/CVY/01/2017-20** | | | | | | | | | | |
| Equipment | - | - | 19,78,538 | 19,78,538 | 19,78,538 | 15 | - | 1,48,390 | 1,48,390 | 18,30,148 |
| **VI. TSAMRC** | | | | | | | | | | |
| Equipment | 3,52,010 | 49,68,756 | 34,20,012 | 83,88,768 | 87,40,778 | 15 | 7,98,115 | 2,56,501 | 10,54,616 | 76,86,162 |
| ***Total (B)*** | **65,51,203** | **51,75,683** | **1,66,54,526** | **2,18,30,209** | **2,83,81,412** | | **17,59,033** | **4,37,844** | **21,96,877** | **2,61,84,535** |
| | | | | | | | | | | |
| **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** |
| *Previous Year* ***Grand Total (A+B)*** | ***11,76,18,407*** | ***2,65,70,762*** | ***1,81,36,055*** | ***4,47,06,817*** | ***16,23,25,224*** | | ***2,11,15,350*** | ***11,28,094*** | ***2,22,43,444*** | ***14,00,81,780*** |

PLACE: BANGALORE
DATE : 25-7-18

(VIVEK DUBEY)
ACCOUNTS OFFICER

(SUBHOD M GULVADY)
ADMINISTRATIVE 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, BANGALORE

SCHEDULES FORMING PART OF THE ACCOUNTS FOR THE YEAR ENDED 31ST MARCH 2018

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.

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 from the Current year onwards against the earlier method of routing it through Income and Expenditure 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. **Contingent Liabilities:** Letters of Credits outstanding as on 31.03.2018 was Rs. 4,51,62,546/- and Rs. 50,43,532/- was outstanding at the end of previous year.

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

3. Foreign currency transactions are translated at the rates prevailing on the date of transaction. During financial year 2017-18 Rs. 1,18,33,125/- paid as foreign currency for purchase of scientific equipment and other expenditure as compared to financial year 2016-17 of Rs. 1,63,69,988/-.

4. Balance shown under Saving Bank Accounts Include amounts held by Bank under "Auto Sweep Accounts".

5. **Prior Period adjustments:** Prior period item of Rs. 4,92,389/- is a EMD/SD which was credited to Income and Expenditure account in the previous year as miscellaneous income, now reversed.

6. Depreciation on fixed assets acquired out of Grant-in-aid amounting to Rs. 2,10,26,130/- is debited to Income and Expenditure account. Depreciation on fixed assets acquired out of project funds amounting to Rs. 21,96,877/- is debited to respective earmarked fund account.

7. **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.

8. 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.

9. Schedules 1 to 24 are annexed to and form an integral part of the Balance Sheet as at 31st March 2018 and the Income and Expenditure Account for the year ended on that date.

(VIVEK DUBEY)
ACCOUNTS OFFICER

(SUBHOD M GULVADY)
ADMINISTRATIVE OFFICER

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

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

(PROF. G.U. KULKARNI)
DIRECTOR

(A.B. SHIVA SUBRAMANYAM)
PARTNER

# 19. MISCELLANEOUS

## 19.1. IN-HOUSE COLLOQUIA / SEMINARS

### RESEARCH FELLOWS

#### Thematic

| Title of Colloquia/Seminar | Speaker | Date |
|---|---|---|
| Thematic Seminar: Soft electronics for healthcare applications | Priya Madhuri | 17.07.2017 |
| Recent advances in environmental gas sensors | Sunil Walia | 20.11.2017 |

#### Journal Article based Seminar

| Title of Colloquia/Seminar | Speaker | Date |
|---|---|---|
| A flexible integrated system containing a micro supercapacitor, a photodetector, and a wireless charging coil | Suman Kundu | 11.05.2017 |
| H-bonded donor-acceptor units: Towards high mobility ambipolar organic semiconductors | Madhu Babu Kanakala | 12.05.2017 |
| Flexible and highly sensitive pressure sensors based on bionic hierarchical structures | Indrajit Mondal | 23.05.2017 |
| A molecular nematic liquid crystalline material for high-performance organic photovoltaics | Marlin Baral | 25.05.2017 |
| Helical Nano-Crystallite (HNC) phases: A new type of dark conglomerates | Rekha S. Hegde | 29.05.2017 |
| Photo driven soft robotics | Vaisakh V. M. | 16.06.2017 |
| Ultimate stable underwater superhydrophobic state | Brindhu Malani S. | 13.11.2017 |
| Single step ambient air synthesis of graphene from renewable precursors as electrochemical genosensor | Rajashekhar N. Pujar | 22.12.2017 |
| Self-Organized Frameworks on Textiles (SOFT): Conductive Fabrics for gas sensing and filtration | Sachin A. Bhat | 09.02.2018 |

#### Journal Article based Seminar

| Title of Colloquia/Seminar | Speaker | Date |
|---|---|---|
| Synthesis and characterization of liquid crystalline compounds | Veerabhadraswamy B. N. | 03.07.2017 |
| Thin films of ferroelectric polymers, blends and composites at interfaces | Chandan Kumar | 25.01.2018 |
| Experimental studies on anisotropic soft matter at atmospheric and elevated pressures | Srividhya P. | 20.03.2018 |

## 19.2 COLLOQIA / SEMINARS BY VISITORS

| Title of Colloquia/Seminar | Speaker | Date |
|---|---|---|
| Photo-induced force microscopy | Dr. Sung Park, CEO, Molecular Vista | 04.04.2017 |
| Advancements in field of transmission electron microscopy | Dr. T. Oikawa, Senior Product Manager, JEOL, Singapore | 05.05.2017 |
| Atomic scale capillaries | Dr.Radha Boya University of Manchester, UK | 16.06.2017 |
| Liquid crystal in optoelectronic and biosensor applications | Dr.Santanu Kumar Pal Associate Professor, Chemical Sciences IISER, Mohali | 23.06.2017 |

| Title of Colloquia/Seminar | Speaker | Date |
|---|---|---|
| 50 mV nano-electromechanical (NME) switch | Mr. Bisvas Saha<br>Dept. of Materials Science and Engineering, University of California, Berkeley, CA | 07.07.2017 |
| Coupling of elementary excitations: drawing parallels between excitons and plasmons | Prof. K. George Thomas<br>Indian Institute of Science Education and Reserch - Thiruvananthapuram | 11.07.2017 |
| Dipolar addition and its utility in the synthesis of bio active compounds | Prof. Balakrishna Kalluraya<br>Mangalore University, Mangalore | 21.07.2017 |
| Semiconductor nanocrystals: To dope or not to dope | Prof. Narayan Pradhan<br>Indian Association for the Cultivation of Science, Kolkata | 14.08.2017 |
| Our efforts towards manufacturing of metal and metal oxide nanomaterials by continuous flow methods and the story of "self-expandable non-vascular stents" | Dr. B. L. V. Prasad<br>CSIR-NCL, Pune | 22.08.2017 |
| Fast switching LCD modes | Prof. Lachezar Komitov<br>CEO Tridentic Holding, Professor of Physics, University of Gothenburg, Sweden | 21.09.2017 |
| Modelling thermal transport and machine learning for nanomaterials | Dr. Ankita Katre<br>DTNM Theory Group, LITEN, CEA-Grenoble, France | 12.10.2017 |
| Affordable nano-diagnostics for food, water, and health security | Priyanka Sabherwal<br>Institute of Nano Science and Technology, Mohali | 13.10.2017 |
| Metal-sulfur rechargeable batteries | Prof. Aninda J. Bhattacharyya<br>IISc, Bengaluru | 24.10.2017 |
| Low thermal conductive materials for high performance thermoelectrics | Dr. Kanishka Biswas<br>JNCASR, Bengaluru | 24.10.2017 |
| KPFM and CAFM characterization of 2D layer based interfaces | Prof. B. R. Mehta<br>IIT, Delhi | 24.10.2017 |
| Electronic structure of 2D materials | Prof. Umesh V. Waghmare<br>JNCASR, Bengaluru | 24.10.2017 |
| Solution processed field effect transistors | Prof. K. S. Narayan<br>JNCASR, Bengaluru | 25.10.2017 |
| Photoelectron spectroscopy for nanomaterials using synchrotron techniques | Prof. D. D. Sarma<br>IISc, Bengaluru | 25.10.2017 |
| Growth property correlations in 2D materials | Prof. S. Raghavan<br>IISc, Bengaluru | 26.10.2017 |
| Scanning tunneling spectroscopy and differential conductance images of compound semiconductors in their lower-dimensional forms | Prof. Amlan J. Pal<br>IACS, Kolkata | 26.10.2017 |
| From minerals to functional materials: experiments with VTXRD measurements | Prof. T. N. Guru Row<br>IISc, Bengaluru | 27.10.2017 |
| Semiconductor nanostructures | Prof. S. M. Shivaprasad<br>JNCASR, Bengaluru | 27.10.2017 |

| Title of Colloquia/Seminar | Speaker | Date |
|---|---|---|
| Coupling of elementary electronic excitations: Drawing parallels between excitons and plasmons | Prof. K. George Thomas<br>IISER, Thiruvananthapuram | 30.10.2017 |
| Nanoindentation | Prof. U. Ramamurty<br>IISc, Bengaluru | 31.10.2017 |
| Raman spectroscopy of nanomaterials | Prof. Chandrabhas Narayana<br>JNCASR, Bengaluru | 31.10.2017 |
| Aberration corrected HRTEM: Basics and application in materials science | Prof. Ranjan Datta<br>JNCASR, Bengaluru | 01.11.2017 |
| X-ray scattering techniques to study the structure of nanomaterials | Prof. Mrinmay K. Mukhopadhyay<br>SINP, Kolkata | 02.11.2017 |
| Electron microscopy of materials | Prof. N. Ravishankar<br>IISc, Bengaluru | 03.11.2017 |
| Towards non-equilibrium supramolecular materials | Dr. Subi Jacob George<br>Associate Professor,<br>New Chemistry Unit,<br>JNCASR, Bengaluru | 10.11.2017 |
| Quantum crystallography: A charge density route to understand molecular interactions | Prof. T. N. Guru Row<br>Solid State and Structural Chemistry Unit, Indian Institute of Science, Bengaluru | 15.12.2017 |
| Photophysical, sensing, and bioimaging study in polymeric nanoparticle system | Dr. Soumitra Satapathi<br>Assistant Professor,<br>Department of Physics,<br>IIT Roorkee | 19.12.2017 |
| 3D printing of metals: challenges and opportunities for materials science and engineering | Prof. Upadrasta Ramamurty<br>Department of Materials Engineering, Indian Institute of Science, Bangalore | 12.01.2018 |
| Novel Lab based X-ray spectroscopy techniques for non-destructive tracelevel chemical mapping (2D & 3D), ultra thin film thickness monitoring and electronic state characterization at micron resolution | S H Lau<br>Vice President of Business Development, Sigray Inc. | 19.01.2018 |
| Frequency-based detection of magnetic particles at the nano-scale | Manu Sushruth<br>University of Western Australia under the supervision of<br>Dr. Peter Metaxas and<br>Prof. Mikhail Kostylev | 24.01.2018 |
| New trends in crystalline Si based solar cells | Dr. Aldrin Antony<br>National Centre for Photovoltaics Research and Education (NCPRE),<br>IIT Bombay | 14.02.2018 |
| Investigation of the structure and thermal behaviour of polymer liquid crystal / single wall carbon nanotubes nanocomposite | Dr. Ginka Kaltcheva Exner<br>Associate Professor,<br>Plovdiv University, Bulgaria | 02.03.2018 |
| Flexoelectric and electric impedance spectroscopy studies of nanostructured nematic liquid crystals | Dr. Yordan G. Marinov<br>Associate Professor,<br>Georgi Nadjakov Institute of Solid State, Physics, Bulgarian Academy of Sciences, Bulgaria | 02.03.2018 |

| Title of Colloquia/Seminar | Speaker | Date |
|---|---|---|
| Inorganic nanotubes and fullerene-like nanoparticles at the crossroad between materials science and nanotechnology and their applications | Prof. R. Tenne Department of Materials and Interfaces, Weizmann Institute, Rehovot 76100, Israel | 12.03.2018 |

## 19.3 FACULTY VISITS INDIA/ABROAD

### Prof. G.U. Kulkarni

| Place and period of visit | Purpose of visit | Title of talk |
|---|---|---|
| Bengaluru 25.09.2017 | CeNS-IGSTC Joint Workshop | Highly Conformal Ni Electrode for Si Solar Cell |
| University of Mysore Mysore 01.03.2018 | International Conference on Nanomaterials | Plenary address: Supramolecular Sensors, Transistors and and their Supercapacitors Applications |
| Bhutan 12-13 March 2018 | Conference on "Physics and Chemistry of Materials" | A micro-supercapacitor made of supramolecular nanofibre based solid electrolyte |

### Dr. S. Krishna Prasad

| Place and period of visit | Purpose of visit | Title of talk |
|---|---|---|
| Manipal University, Manipal 27-28 Jun. 2017 | CeNS-Manipal Joint Workshop | Influence of imposed meso/nano-networks on anisotropic soft matter |
| Ramaiah Univ. of Appl.Sc., Bengaluru 18-19 Aug. 2017 | National Conference on Advances in Materials Research | Anisotropic soft matter |
| SJR College for Women, Bengaluru 30.08.2017 | Science Academies' Lecture workshop on "Nano-Science & Nano-Technology" | Technological Applications of an anisotropic soft matter |
| JNCASR, Bengaluru 14.09.2017 | DAE-Raja Ramanna Lectures in Physics 2017 | Light: A powerful tool to study liquid crystals |
| IISER, Mohali 11-13 Oct. 2017 | 24th National Conference on Liquid Crystals | On the photonic band gap, photoluminescence and fast switching of emission |
| Hospet 16-17 Nov. 2017 | CeNS-INST Joint Symposium | Interplay betweenphotonic band gap and photoluminescence in fast switching of anisotropic liquid crystalline emitters |
| Kuvempu University Shivamogga 9-10 Feb. 2017 | Recent Advances in Chemical Biology and Material Science for Industry and Society | Influence of imposed networks on liquid crystals |
| Satish Dawan Auditoriun, IISc, Bengaluru 22.03.2018 | Nano for Youth | Swiss cheese and rolling displays |

### Dr. Geetha G. Nair

| Place and period of visit | Purpose of visit | Title of talk |
|---|---|---|
| Manipal University, Manipal 27-28 Jun. 2017 | CeNS-Manipal Joint Workshop | Photo–driven change in the polar environment tunes gelation in nematic liquid crystal |
| Suntec, Singapore 18-22 Jun. 2017 | 9th International Conference on Materials for Advanced Technologies | Liquid Crystal Metamaterial with Ultra-low Refractive Index |

| Place and period of visit | Purpose of visit | Title of talk |
|---|---|---|
| IISER, Mohali<br>11-13 Oct. 2017 | 24th National Conference on Liquid Crystals | Photo-driven change in the polar environment tunes gelation in nematic liquid crystal |
| Bengaluru<br>23 Oct.-3 Nov. 2017 | Nano Mission School on NS & NT-Physical Sciences Emerging Materials and Methods in Nanoscience & Nanotechnology | Rheology of Soft Materials |
| Hospet<br>16-17 Nov.2017 | CeNS-INST Joint Symposium | Anisotropic organogels: Energy efficient soft functional materials |

### Dr. D.S.Shankar Rao

| Place and period of visit | Purpose of visit | Title of talk |
|---|---|---|
| Manipal University, Manipal<br>27-28 Jun. 2017 | CeNS-Manipal Joint Workshop | Twist-bend nematic phase: An interplay between elasticity and chirality in non–chiral systems<br>Advances in Nano and Soft Materials |
| IISER, Mohali<br>11-13 Oct. 2017 | 24th National Conference on Liquid Crystals | Influence of chirality on the thermal and electric properties of the Columnar mesophase exhibited by homomeric dipeptides |
| Hospet<br>16-17 Nov.2017 | CeNS-INST Joint Symposium | Influence of chirality on the thermal and electric properties of the columnar mesophase exhibited by homomeric dipeptides |
| Kuvempu University, Shimoga<br>9-10 Feb. 2018 | RACBMS-2018 | Influence of chirality on the thermal and electric properties of the columnar mesophase exhibited by homomeric dipeptides |

### Dr. C.V.Yelamaggad

| Place and period of visit | Purpose of visit | Title of talk |
|---|---|---|
| National College, Bangalore<br>3-4 Jun. 2017 | National Conference on Condensed Matter and Space Science | Functional organic materials for various applications. |
| JNCASR, Bengaluru<br>4-5 Jul.2017 | A CeNS- DRDO-JNCASR workshop on Frontiers in Nanoscience and Technology | Fluid and doubly refractive gold nanoparticles: A new class of functional organic-inorganic hybrids |
| Christ University, Bangalore<br>10-11 Aug. 2017 | Workshop on Chemistry in Healthcare and Materials | Liquid Crystals and nanoword; science and technology without boundaries |
| Indian Academy Degree College, Bangalore<br>08.09.2017 | Symposium -2017 | A new class of functional organic-inorganic hybrids: towards, science and technology of invisibility |
| Hospet<br>16-17 Nov. 2017 | CeNS-INST Joint Symposium | Liquid crystal-gold nanoparticle conjugates: Synthesis and characterization |

### Dr. Dr. S. Angappane

| Place and period of visit | Purpose of visit | Title of talk |
|---|---|---|
| Manipal University, Manipal<br>27-28 Jun. 2017 | CeNS-Manipal Joint Workshop | Extraordinary electroresistance in manganite films and magnetic nanoparticles |
| S.J.R. College for Women, Bengaluru<br>29-30 Aug. 2017 | Science Academies' Lecture Workshop on Nano-Science & Nanotechnology | Nano-Lithography & devices |

| Place and period of visit | Purpose of visit | Title of talk |
|---|---|---|
| Hospet<br>16-17 Nov. 2017 | CeNS-INST Joint Symposium | Exchange bias and magnotoimpedance of magnetic nanoparticles |
| University of Mysore, Mysore<br>01.03.2018 | International Conference on Nanomaterials and their Applications | Supramolecular Sensors, Transistors and Supercapacitors |

### Dr. P.Viswanath

| Place and period of visit | Purpose of visit | Title of talk |
|---|---|---|
| Bengaluru<br>23 Oct.-3 Nov. 2017 | Nano Mission School on NS & NT-Physical Sciences Emerging Materials and Methods in Nanoscience & Nanotechnology | Langmuir-Blodgett Films |

### Dr. Neena S. John

| Place and period of visit | Purpose of visit | Title of talk |
|---|---|---|
| University of Aveiro Portugal<br>19-21 Jul. 2017 | International conference on Advanced Nanomaterials | Films of Multifunctional Reduced Graphene Oxide Based Metal and Metal Oxide Nanostructures by Interfacial Reaction for Application as Sensors |
| SJR college for Women, Bengaluru<br>29.08.2017 | Science Academies Lecture Workshop on Nanoscience and Nanotechnology | Synthesis of Nanomaterials |
| Hamburg, Germany<br>20-22 Oct. 2017 | DESY Photon Science to perform 2D GIXD at Synchrotron facility | |
| Hospet<br>16-17 Nov. 2017 | CeNS-INST Joint Symposium | Metallophthalocyanine thin films and nanostructures |

### Dr. Pralay K. Santra

| Place and period of visit | Purpose of visit | Title of talk |
|---|---|---|
| Bengaluru<br>25.09.2017 | CeNS-IGSTC Joint Workshop | Colloidal Quantum Dot Solar Cell based on Lead Sulfide and Cesium Lead Halide Perovskite |
| Hospet<br>16-17 Nov. 2017 | CeNS-INST Joint Symposium | Internal heterostructureof Anion exchanged Cesium Lead Halide Nanocubes |
| SNBNCBS, Kolkata<br>14-15 Dec. 2017 | HyPe - 2017, A discussion meeting on hybrid perovskites | Ineternal Heterostructure of Pure and Anion Exchanged $CsPbX_3$ Nanocubes |
| IISER, Kolkata<br>14-16 Dec. 2017 | Newton Bhabha Researcher Links Workshop | Role of Molecular Ligands on Orientation and Surface of Nanocrystals |
| Kuvempu University, Shivamogga<br>9-10 Feb 2018 | Recent Advances in Chemical Biology and Material Science for Industry and Society | Ineternal Heterostructure of Pure and Anion Exchanged $CsPbX_3$ Nanocubes |

### Dr. H.S.S.R. Matte

| Place and period of visit | Purpose of visit | Title of talk |
|---|---|---|
| Manipal University, Manipal<br>27-28 Jun. 2017 | CeNS-Manipal Joint Workshop | In search of alternatives to fullerenes for organic photovoltaics |
| Bengaluru<br>4-5 Jul. 2017 | CeNS-DRDO-JNCASR workshopon 'Frontiers in Nanoscience and Technology' | In search of alternatives to fullerenes for organic photovltaics |

| Place and period of visit | Purpose of visit | Title of talk |
|---|---|---|
| Bengaluru<br>6-7 Jul. 2017 | PPISR Founder's Day Celebration | In search of alternatives to fullerenes for organic photovoltaics |
| Bengaluru<br>25.09.2017 | CeNS-IGSTC Joint Workshop | In Search of Alternatives to Fullerenes for Organic Photovoltaics |
| JNCASR, Bengaluru<br>01-03 Oct. 2017 | 13th JNCASR Research Conference, "Chemistry of Materials-2017" | In search of alternatives to fullerenes for organic photovltaics |
| Hospet<br>16-17 Nov. 2017 | CeNS-INST Joint Symposium | Highly concentrated and stable semiconducting inks in low boiling point solvents for printed electronics |
| JNCASR, Bengaluru<br>7 Dec. 2017 | JNCASR/C N R Rao Education Foundation - Lecutre for School Students | Nanoscience: The New and Big Science of Small |
| Government College, Rajahmundry, A.P.<br>9-10 Feb. 2018 | International Conference on Renewable Energy Research and Education | Highly concentrated and stable semiconducting inks in low boiling point solvents for printed electronics<br>Role of nanomaterials in Renewable Energy |
| ABNPBR College, Kovvur, A.P.<br>9 Feb. 2018 | Lecture for M.Sc Students | Nanoscience: The New and Big Science of Small |
| Thimphu, Bhutan<br>12-13 Mar. 2018 | Conference on "Physics and Chemistry of Materials" | Highly concentrated and stable semiconducting inks in low boiling point solvents for printed electronics |
| Bengaluru<br>21-23 Mar. 2018 | International conference on Nanoscience & Nanotechnology | Strategies for the synthesis of few-layer low-band gap g-$C_3N_4$ |

## Prof. K.A. Suresh

| Place and period of visit | Purpose of visit | Title of talk |
|---|---|---|
| Mangaluru | Talks given at Mangalore University<br>04.04.2017<br>05.04.2017<br>06.04.2017<br>07.04.2017<br>07.02.2018<br>08.02.2018<br>09.02.2018 | <br>Teaching methods<br>Liquid Crystals I<br>Liquid Crystals II<br>Writing project proposals<br>Liquid Crystals I<br>Liquid Crystals II<br>Surfaces and Interfaces I<br>Surfaces and Interfaces II |
| IISER, Mohali<br>11-13 Oct. 2017 | 24th National Conference on Liquid Crystals | Phase and thickness behaviours of films of cholesterol and cholesteryl esters at interfaces |
| IISER, Mohali,<br>14.10.2017 | Colloquium | Recent advances in discotic liquid crystals |
| Manipal University, Manipal<br>13.11.2017 | Conference on 'Recent Advances in Photonics' | Fluorescent dye induced spreading and retraction dynamics of liquid crystal domains |
| IIT-Bombay, Mumbai<br>23.11.2017 | Colloquium | Charge transport in liquid crystalline monomer and polymer ultra thin films |
| MangaloreUniversity, Mangalore<br>23-25 Jan. 2018 | International Conference on 'Recent Advances in Materials Science and Biophysics' | Self-assembly and phase behavior of cholesterol and cholesteryl derivatives at interfaces |

## 19.4. ACADEMIC ACTIVITIES OF RESEARCH STUDENTS AND POSTDOCTORAL FELLOWS

| No. | Date(s) | Name & Designation* | Name of Conference | Presentation Mode & Title |
|---|---|---|---|---|
| 1. | 19.06.2017 | Brindhu Malani S, SRF | CeNS-DRDO-JNCASR Frontiers in Nanoscience and technology | Poster: Colloidal monolayer lithography |
| 2. | 27-28 Jun. 2017 | Marlin Baral, SRF | CeNS-Manipal University Joint Workshop | Poster: CNT-reinforced polymer stabilized LCD |
| 3. | | Monika M., SRF | | Poster: Smectic Nano clusters in the Nematic Mesophases of dimeric compounds composed of rod like azo moieties with lateral substituents |
| 4. | | Vivek Ramakrishnan, RA | | Poster: Vertically Aligned Hexagonal $MoO_3$ Nanorods |
| 5. | 4-5 Jul. 2017 | Priya Madhuri K, SRF | Workshop on "Frontiers in Nanoscience and Technology" | Poster: Graphene-Metallophthalocyanine Nanofibre Composites as Hybrid Capacitors |
| 6. | 9-11 Aug. 2017 | Priya Madhuri K, SRF | 4th International Conference on Nanoscience and Nanotechnology (ICONN-2017) | Oral: Supercapacitor Application of Nickel Phthalocyanine Nanofiber and Reduced Graphene Oxide Composite |
| 7. | 20-22 Sep. 2017 | Chandan Kumar, SRF | 8th East Asia Symposium on functional dye and advanced materials(EAS8), CSIR-NIIST, Thiruvananthapuram | Poster: Surface morphology, and wettability of poly(vinylidene fluoride)/poly(methyl methacrylate) film prepared by Langmuir-Schaefer method |
| 8. | 11-13 Oct. 2017 | Pragnya Satapathy, JRF | 24th National Conference on Liquid Crystals, Mohali, Punjab | Poster: Anisotropic and switchable emission in $CsPbBr_3$ perovskite quantum dot/nematic liquid crystal composites |
| 9. | | Sujeet Dutta, NPDF | | Poster: Influence of nanoconfinement on the structure and dynamics of miscible binary liquids and liquid crystalline materials |
| 10. | | Marlin Baral,SRF | | Oral: Carbon nanotube reinforced polymer stabilized liquid crystal device: Lowered and thermally invariant threshold with accelerated dynamics |
| 11. | | Sachin Ashok Bhat, SRF | | Poster: Optically Active Liquid Crystal Dimers Derived from Cholesterol: Synthesis and Characterization |
| 12. | | Madhu Babu Kanakala, SRF | | Poster : Molecular Design, Synthesis and Characterization of Liquid Crystal Dimers Derived from Naturally Occurring Steroid |

| No. | Date(s) | Name & Designation* | Name of Conference | Presentation Mode & Title |
|---|---|---|---|---|
| 13. | 16-17 Nov. | Vimala S., SRF | CeNS-INST Joint Symposium, Hospet | Oral: Electrically tunable soft photonic gel formed by blue phase liquid crystal |
| 14. | | Arup Sarkar, SRF | | Oral: Negative differential resistance in nickel octabutoxy phthalocyanine and nickel octabutoxy phthalocyanine / graphene oxide ultrathin films |
| | | | | Poster : Negative differential resistance in nickel octabutoxy phthalocyanine / graphene oxide ultrathin films |
| 15. | | Sunil Walia, SRF | | Oral: Transparent Faraday cage |
| 16. | | Marlin Baral, SRF | | Oral: Carbon nanotube reinforcement caused thermally invariant operating voltage and accelerated dynamics in a polymer stabilized liquid crystal device |
| 17. | | Brindhu Malani S, SRF | | Poster: Colloidal monolayer lithography |
| 18. | | S. Vimala, SRF | | Oral: Electrically tunable soft photonic gel formed by blue phase liquid crystal |
| 19. | | Marlin Baral, SRF | | Oral: Carbon nanotube reinforcement caused thermally invariant operating voltage & accelerated dynamics in a polymer stabilized liquid crystal device |
| 20. | | Vivek Ramakrishnan, RA | | Poster : Architecturing Metallic and Semiconducting Molybdenum Oxide Nanostructures on Rigid Substrates |
| 21. | 7-8 Dec. | Sunil Walia, SRF | 9th Bangalore India Nano | Poster : Transparent Faraday Cage |
| 22. | 2017 | Trupthi Devaiah C., JRF | | Poster :Photoluminescence Based Sensor for Heavy Metal Ions- Prompt and Simple Detection |
| 23. | | Gaurav Shukla, JRF | | Poster: 'Study of diffuse reflectance of textured Cu films' |
| 24. | 18-20 Dec. 2017 | Brindhu Malani S (SRF) | CompFlu IITM | Poster: Hydrophobic-hydrophilic patterned surfaces with selective wettability |
| 25. | 26-30 Dec. 2017 | Gaurav Shukla, JRF | 62nd DAE Solid State Physics Symposium (DAE SSPS-2017) | Poster: Relation between textured surface and diffuse reflectance of Cu films |
| 26. | 8-12 Jan. 2018 | Athira M, JRF | GIAN programme on 'Advanced Materials and Future Technologies for Solar Energy Conversion' at IIT Jodhpur | PPT on 'Perovskites' |

| No. | Date(s) | Name & Designation* | Name of Conference | Presentation Mode & Title |
|---|---|---|---|---|
| 27. | 21-23 Mar 2018 | Sujeet Dutta, NPDF | International Conference on Nanoscience and Technology (ICONSAT-2018) | Oral: Effect of nanoconfinement on rotator phase forming alkanes |
| 28. | | Dr.Umesha Mogera, RA | | Poster : Decoupled Graphene Multilayers and its Extraordinary Properties |
| 29. | | Brindhu Malani S SRF | | Poster : Optical properties of ordered gold nanohole array from non-close packed assembly of colloidal microsphere |
| 30. | | Trupthi Devaiah C JRF | | Poster : Origin of Luminescence Based Detection of Metal Ions by Mn doped ZnS Quantum Dots |
| 31. | | Pragnya Satapathy, JRF | | Poster : Direction dependent photoluminiscence blocking in liquid crystals using ZnO-Ag nano hybrids |
| 32. | | S. Vimala, RA(Prov.) | | Poster : Facile Tuning of Selective Reflection in a Soft Photonic Gel formed by Blue Phase Liquid Crystal |
| 33. | | Remya K Govind, RA | | Poster : Large Area Fabrication of Flexible Transparent Conducting Mesh Electrodes by Screen Printing |
| 34. | | Indrajit Mondal, JRF | | Poster : Large Area Smart Windows for Indoor Light and Heat Modulation |
| 35. | | Marlin Baral,SRF | | Poster : A novel strategy for a faster temperature-independent electro-optic liquid crystal switch using carbon nanoforms |
| 36. | | Rajesh Katoch, RA | | Poster: Giant magnetoresistance in carbon coated Ni/NiO nanocomposite |
| 37. | | Madhu Babu Kanakala, SRF | | Poster : Gold Nanoparticles Coated with Optically Active Mesogenic Ligands: Synthesis and Characterization |
| 38. | | Ashutosh Kumar Singh, Project Scientist C | | Oral: Affordable Smart Windows |
| 39. | | Vivek Ramakrishnan, RA | | Poster : Metallic $MoO_2$ Nanostructures - Tuning the Morphology and its Application to Electro-Chemical Water Activation |
| 40. | | Prashanth Nayak, JRF | | Poster : Growth studies on LB films of Nickel(II) 1, 4, 8, 11, 15, 18, 22, 25-octabutoxy-29H,31H phthalocyanine |

## 19.5 CONFERENCE / SYMPOSIA / SEMINARS / WORKSHOPS ORGANIZED

The second **CeNS – Manipal University Joint Workshop** based on the theme "Advances in Nano and Soft Materials" was held at CeNS, Bengaluru on 27-28 June 2017.

A **Joint workshop between CeNS, DRDO and JNCASR** on "Frontiers in Nanoscience and Technology" was held on 4 – 5 July 2017 at JNCASR, Bengaluru

*CeNS, DRDO and JNCASR scientists participating in the joint workshop "Frontiers in Nanoscience and Technology"*

**IGSTC Workshop** on "Solar photovoltaics: Materials, Mechanisms and Methods" was held on 25 September 2017 at CeNS.

**A Joint Symposium involving CeNS, Bengaluru and INST, Mohali,** organized by CeNS, was held during 16-17 November 2017 at Hospet, Karnataka. Bharat Ratna Professor C N R Rao, Chairman, Governing Council, CeNS and Chairman, Board of Governers, INST in his opening remarks, stressed the importance of doing quality scientific research and building active collaborations between the two institutes. The presentations covered topics in nano-, bio-, and soft matter sciences with an emphasis on nanoscience-related research and technology. Each scientific session was followed by a lively discussion which culminated in newer ideas.

**Nanomission School on "Nanoscience and Nanotechnology-Physical Sciences",** 2017, sponsored by DST Nanomission, Govt. of India, was organized by CeNS at the Jalahalli campus, Bengaluru, from 23 October– 3 November 2017. The theme of the School was 'Emerging Materials and Methods in Nanoscience and Nanotechnology' focussing on frontier areas of materials research. The inaugural lecture was given by Bharat Ratna Prof. C N R Rao, FRS, on 'Glimpses of the Nanoworld'. Around 40 participants consisting of Ph.D students, postdoctoral fellows and young faculty, from all over India participated in the School. Visits to C-CAMP, NCBS was arranged to introduce the participants to translational research. They also visited the Bruker Application Centre to learn about advanced probe microscopic techniques.

*Prof. K. George Thomas, IISER, Trivandrum, interacting with Nanomission school participants*

**The Conference on Physics and Chemistry of Materials** was organised during 12–13 March 2018, at Thimphu, Bhutan. The conference mainly focused on nanomaterials with applications related to energy and environment. Nearly twenty invited lectures were delivered on various topics such as electrical, mechanical, magnetic, optical, transport, growth mechanisms, formation process, and theoretical simulations of nanoscale systems and materials.

The Centre organized **International Conference on Nano Science and Technology 2018** under the aegis of Nano Mission, Department of Science and Technology (DST), Government of India, during 21-23 March 2018 at Indian Institute of Science (IISc), Bengaluru. The conference was inaugurated by Bharat Ratna Prof. C.N.R. Rao, FRS, and attended by nearly 600 participants, which included several

luminaries from the academia and industry, and young entrepreneus from all over the world. The Conference mainly focussed on several thematic topics in the field of nano science and technology, bringing out cutting edge developments in the domain of material as well as biological sciences.


*Bharat Ratna Prof. C. N. R. Rao, FRS, delivering inaugural speech at the ICONSAT-2018*

A special programme **"Nano for Youth",** was conducted at the Satish Dhawan Auditorium in the campus of IISc, Bengaluru on 22 March 2018, ICONSAT 2018. The programme, supported by Nano Mission, DST, Government of India, was modelled based on a concept by Bharat Ratna Prof. C. N. R. Rao, FRS, JNCASR, Bengaluru, who is also the patron of Nano Mission. The event was mentored by Prof. D. D. Sarma, IISc, Bengaluru, with Prof. G. U. Kulkarni, Director, CeNS as advisor. The programme was specially designed for B.Sc/B.Tech/M.Sc students to nurture curiosity and inspire interest in the field of Nano science and technology. It provided the participants a rare opportunity to interact with renowned scientists. Four invited talks were delivered by well-known researchers. 375 students and the associated teaching faculty from 22 colleges participated in the programme.


*A glimpse of "Nano for Youth" program held on 22 March 2018*

# ANNEXURE - A

**In Refereed Journals**

1. Highly Efficient Flexible Quantum Dot Solar Cells with Improved Electron Extraction Using MgZnO Nanocrystals. Zhang, X.; Santra, P. K.; Tian, L.; Johansson, M. B.; Rensmo, H.; Johansson E. M. *J. ACS Nano.* **2017,** 11, 8478. IF: 13.942

2. Internal Heterostructure of Anion Exchanged Cesium Lead Halide Nanocubes, Anamul Haque, Vikash Kumar Ravi, G. Shiva Shanker, Indranil Sarkar, Angshuman Nag, and Pralay K. Santra, *J. Phys. Chem. C* **2018** (DOI:10.1021/acs.jpcc.7b11118) IF: 4.536

3. Studies on Fluorescence Quenching of DBSA-PANI Employing Nitroaromatics. V. Lakshmidevi, C. V. Yelamaggad and A. Venkataraman. *Chemistry Select,* **2018,** 3, 2655-2664. (IF – Yet to be announced)

4. Excited state intramolecular proton transfer emission in bent core liquid crystals.A. K. Satapathy, S. K. Behera, Rajeev Kumar, K. L. Sandhya, C.V.Yelamaggad and Balaram Sahoo. *J. Photochem. Photobiol., A: Chemistry,* **2018,** 358, 186. IF: 2.62

5. Ferroelectric Liquid Crystals: Synthesis and Thermal Behavior of Optically Active, Three-Ring Schiff bases and Salicylaldimines. B. N. Veerabhadraswamy, D. S. Shankar Rao and C. V. Yelamaggad. *Chem. Asian J.,* **2018,**, 13, 1012-1023. IF: 4.08

6. Columnar Self-Assembly of Electron-Deficient Dendronized Bay-Annulated Perylene Bisimides, R.K. Gupta, D. S. Shankar Rao, S. Krishna Prasad and A. S. Achalkumar, *Chem. Eur. J, 24, 3566* **(2018).** IF 5.16

7. GrapheneNi(111) Synergy Influencing Crystalline Orientation, Grain Morphology and Magnetic Properties of Poly-Ni, Umesha Mogera, A. Sundaresan and Giridhar U. Kulkarni. *J. Phys. Chem. C,* **2018,** DOI 10.1021/acs.jpcc.8b01119. IF: 4.536

8. One -Dimensional Porphyrin-Fullerene (C60) Assemblies: Role of Central Metal Ion in Enhancing Ambipolar Mobility, Goudappagouda., Gedda, M., Kulkarni, G.U., and Santhosh Babu, S. *Chemistry - A European Journal,* **2018,** 24, 1-8. IF: 5.317

9. Parallel cracks from a desiccating colloidal layer under gravity flow and their use in fabricating metal micro-patterns, Mondal, I. K., Ankush.,Rao,K.D.M. & Kulkarni,G. U. (2018). *Journal of Physics and Chemistry of Solids,* **2018,** 118, 232-237. IF:2.059

10. Enhanced electrocatalytic activity of reduced grapheme oxide-Os nanoparticle hybrid films obtained at a liquid/liquid interface, K. Bramhaiah ., Pandey, I. S., Vidya N ., & Kavitha, C., & John, N S. *Journal of Nanoparticle Research,* **2018,** 20(3), 20:56. IF:2.020

11. Giant enhancement of photoluminescence and tertiary emission in a chiral nematic by matching photonic band gap and excitation wavelength, Baral, M., Prasad, S. K., Patel,Himali ., Achalkumar, A.S., & Yelamaggad, C.V. *Journal of Molecular Liquids,* **2018,** 262, 354–362. IF: 3.648

12. Nano-layered TiO2 for effective bacterial disintegration of waste activated sludge and biogas production, Sharmila, V. G., Banu, J R., Gunasekaran, M .,Angappane, S., & Yeom, I. T. *Journal of Chemical Technology and Biotechnology,* **2018,** IF: 3.135

13. The first examples of V-shaped compounds exhibiting a B5mesophaseand a direct transition from the isotropic to a polar biaxial smectic Amesophase, Hegde, Rekha. S.,Kumar, Jitendra ., Prasad, Veena., & Monika, M. *Journal of Molecular Liquids,* **2018,** 249, 97-105. IF: 3.648

14. Triboelectric Nanogenerator Based on Biocompatible and Easily Available Polymer Films, Satturappa, R; Srither., Doddamane S. Shankar Rao., & Subbarao, K. P. *Chemistry Select,* **2018,** 3, 5055–5061.

15. Phase transition analysis of V-shaped liquid crystal: Combined temperature-dependent FTIR and density functional theory approach, Singh, S.; Singh, H.; Karthick, T.; Tandon, P.; Prasad, V. *Spectrochim. Acta A.,* **2018,**188, 561. Impact Factor: 2.53

16. Effect of ZnO nanoparticles on the morphology, dielectric, electro-optic and photo luminescence properties of a confined ferroelectric liquid crystal material, Jayoti, D.; Malik, P.; Prasad, S.K. *J. Mol. Liq.,* **2018,** 250, 381. Impact Factor: 3.648

17. Current distribution in conducting nanowire networks, Kumar, A.; Vidhyadhiraja, N. S.; Kulkarni, G. U. *J. Appl. Phys.,* **2017,** 122(4). Impact Factor: 2.068

18. Solvent driven polymorphism in Langmuir and Langmuir Schaefer film of poly(vinylidene fluoride), Kumar, C.; Viswanath, P. *Eur. Polym. J.,* **2017,** 86, 132-142. Impact Factor: 3.531

19. Electrically tunable soft photonic gel formed by blue phase liquid crystal for switchable color-reflecting mirror, Vimala, S.; Mathews, M.; Yelamaggad, C. V.; Nair, G. G. *ACS Appl. Mater. Interfaces,* **2017,** 9, 39569-39575. Impact Factor:7.503

20. Size-induced enhancement of carrier density, LSPR quality factor, and carrier mobility in Cr–Sn doped In2O3 nanocrystals, Tandon, B.; Yadav, A.; Khurana, D.; Reddy, P.; Santra, P. K.; Nag, A. *Chem. Mater,* **2017,** 29, 9360–9368. Impact Factor: 9.466

21. Mesomorphic Schiff base amine tethered giant gold nanoparticles, Das, N.; Acharya, H.; Prasad, S. K.; Rao, D. S. S.; Bhattacharjee, C. R. *Liq. Crys.,* **2017,** 44, 2259-2266. Impact Factor:2.20

22. Investigation of liquid crystalline property of a new calamitic liquid crystalline system methyl 4-(4'-(4"-(decyloxy)benzyloxy) benzylideneamino)benzoate, Nandi, R.; Singh, H. K.; Singh, S. K.; Rao, D. S. S.; Prasad, S. K.; Singh, B.; Singh, R. K. *Liq. Crys.,* **2017,** 44, 1185-1193. Impact Factor:2.20

23. Origin of substitution mechanism for the binding of organic ligands on the surface of CsPbBr3 Perovskite nanocubes, Ravi V. K.; Santra, P. K.; Joshi, N.; Chugh, J.; Singh, S. K.; Rensmo, H.; Ghosh, P.; Nag, A. *J. Phys. Chem. Lett.,* **2017,** 8, 4988–4994. Impact Factor: 9.353

24. Unsymmetrical achiral four ring hockey stick shaped mesogens based on 1,3,4-oxadiazole: Photophysical, mesogenic and DFT studies, Saha, S. K.; Bhattacharya, B.; Sarkar, U.; Rao, D. S. S.; Paul, M. K. *J. Mol. Liq.,* **2017,** 241, 881-896. Impact Factor : 3.658

25. Rapid augmentation of vertically aligned $MoO_3$ nanorods via microwave irradiation, Singh, K. K.; Ramakrishnan, V.; Prabhu, B. R.; John, N. S. *CrystEngComm,* **2017,** 19, 6568-6572. Impact Factor: 3.474

26. Aging effect on the resistive switching in ZnO thin film, N. Kambhala.; S. Angappane.; *Phys. Status Solidi B,* DOI: 10.1002/pssb.201700208. Impact Factor: 1.674

27. Influence of thickness on structural and magnetic properties of co-rich $Bi_{10}Co_{16}O_{38}$ sillenite thin films, U. P. Mohammed Rasi.; J. Arout Chelvane.; S. Angappane.; P. Magudapathy.; S. Amirthapandian.; R. B. Ganginen. *J. Supercond. Nov. Magn.,* **2017,** 31, 1623–1629. Impact Factor :1.180

28. Anomalous magneto-transport properties of Bi doped $La_{0.67}Sr_{0.33}MnO_3$, N. Kambhala.; Samatham S.; Venkatesh, V .; Ganesan, V.; Angappane. S. *Phys. Status Solidi B,* DOI: 10.1002/pssb.201700194. Impact Factor: 1.674

29. Transparent and flexible supercapacitors with networked electrodes, S. Kiruthika.; Sow, C.; Kulkarni, G. U. *Small,* **2017,** 1701906. Impact Factor: 8.315

30. Influence of Zn concentration on the structural and magnetic properties of nanocrystalline Cu1–xZnx$Fe_2O_4$ mixed ferrites synthesized using novel combustion method, Murugesan, C.; Kambhala, N.; Angappane, S.; Chandrasekaran, G. J. *Magn. Magn. Mater.,* **2017,** 443, 334-342. Impact Factor: 2.630

31. Supercapacitor application of nickel phthalocyanine nanofibres and its composite with reduced graphene oxide, Madhuri, K.P.; John, N.S. *Appl. Surf. Sci.* **(2017),** DOI: 10.1016/j.apsusc.2017.12.021. Impact Factor : 3.3

32. Viologen-based conjugated covalent organic networks via zincke reaction, Das, G.; Skorjanc, T.; Sharma, S.K.; Gandara, F.; Lusi, M.; Rao, D.S.S.; Sridurai, V.; Prasad, S.K.; Raya, J.; Han, D. S.; Jagannathan, R.; Olsen, J.C.; Trabolsi, A. *J. Am. Chem. Soc.,* **2017,** 139, 9558–9565. Impact Factor : 13.858

33. Carbon nanotube reinforced polymer-stabilized liquid crystal device: Lowered and thermally invariant threshold with accelerated dynamics, Prasad, S.K.; Baral, M.; Murali, V.; Jaisankar, S.N. *ACS Appl. Mater. Interfaces,* **2017,**9, 26622. Impact Factor : 7.504

34. Improving the quality of graphene/Cu by joule heating and enabling polymer-free direct transfer onto arbitrary substrates, Mogera, U.; Kulkarni, G. U. *Carbon,* **2017,** 124, 525-530. Impact Factor: 6.337

35. A supramolecular nanofibre based passive memory device for remembering past humidity; Mogera, U.; Gedda, M.; George, S.J.; Kulkarni, G.U. *ACS Appl. Mater. Interfaces,* **2017,** 9, 32065. Impact Factor : 7.504

36. Connector type-controlled mesophase structures in poly(propyl etherimine) dendritic liquid crystals of identical dendrimer generations, Kumar P.; Rao, D.S.S.; Prasad, S. K.; Jayaraman, N. *J. Polym. Sci., Part A: Polym. Chem.,* **2017,** 55, 3665–3678. Impact Factor: 2.952

37. Improved surface-enhanced Raman and catalytic activities of reduced graphene oxide–osmium hybrid nano thin films, Kavitha C.; Bramhaiah K.; John, N. S.; Aggarwal S. R. *Soc. Open Sci.* **2017,** 4, 170353. Impact Factor: 2.243

38. Influence of substrate heating and annealing on the properties and photoresponse of manganese doped zinc oxide thin films, Sugumar, R.; Angappane, S. *Superlattices Microstruct.,* **2017,** 110, 57-67. Impact Factor: 2.123

39. Electrophilic fluorination of α-$Fe_2O_3$ nanostructures and influence on magnetic properties, Bahuguna, G.; Janu,V.C .; Uniyal, V.; Kambhala, K.; Angappane, S.; Sharma, R.K.; Gupta, R . *Mater. Des.,* **2017,** 135, 84–91. Impact Factor:4.364

40. Influence of chirality on the thermal and electric properties of the columnar mesophase exhibited by homomeric dipeptides, Parthasarathi, S.; Rao, D.S.S.; Prabhu, R.; Yelamaggad, C.V.; Prasad, S. K. *J. Chem. Phys.,* **2017,** 147, 134905. Impact Factor: 2.965

41. Zinc(II)-salphen complexes bearing long alkoxy side arms: Synthesis, solvent dependent aggregation, and spacer group substituent effect on mesomorphism and photophysical property, Chakraborty, S.; Mondala, P.; Prasad, S.K.; Rao D.S.S.; Bhattacharjee, C.R. *J. Mol. Liq.* **2017,** 246, 290. Impact Factor: 3.648

42. Smectic nano clusters in the nematic mesophases of dimeric compounds composed of rod-like azo moieties with lateral substituents, M. Monika.; Arun Roy.; Veena Prasad. *New J. Chem.,* **2017,** 41, 11576. Impact Factor: 3.27

43. Intrinsic nature of graphene revealed in temperature dependent transport of twisted multilayer graphene, Mogera U.; Walia S.; Bannur B.; Gedda M.; Kulkarni G. U. *J. Phys. Chem. C,* **2017,** DOI: 10.1021/acs.jpcc.7b04068. Impact Factor: 4.536

44. Fabrication of solar and electrically adjustable large area smart windows for indoor light and heat modulation, Singh A. K.; Kiruthika, S.; Mondal I.; Kulkarni G. U. *J. Mater. Chem. C,* **2017,** DOI: 10.1039/C7TC01489A. Impact Factor: 5.256

45. Nanomaterials for clean energy and environmental sensors: An India–U.S. Workshop, Timothy, S. F.; Kulkarni G. U. *ACS Energy Lett.,* **2017,** 2, 1137–1138.

46. Microscopic evaluation of electrical and thermal conduction in random metal wire networks, Gupta, R.; Kumar, A.; Sadasivam, S.; Walia S.; Kulkarni G. U.; Fisher T. S.; Marconnet, A. *ACS Appl. Mater. Interfaces,* **2017,** 9, 13703-13712. Impact Factor:7.504

47. In-Situ GISAXS study of supramolecular having ultrafast humidity sensitivity, Bhattacharyya, A.; Sanyal, M. K.; Mogera, U.; George, S. J.; Mukhopadhyay, M. K.; Maiti, S.; Kulkarni, G. U. *Sci. Rep.,* **2017,** 7, 246. Impact Factor: 4.259

48. Highly conformal Ni micromesh as a current collecting front electrode for reduced cost Si solar cell, Gupta, N.; Rao, K. D. M.; Gupta, R.; Krebs, F. C.; Kulkarni, G. U. *ACS Appl. Mater. Interfaces,* **2017,** 9 (10), 8634-8640. Impact Factor: 7.504

49. Energy efficient hydrogel based smart windows with low cost transparent conducting electrodes, Kiruthika, S.; Kulkarni, G. U. *Sol Energ Mat Sol C,* **2017,** 163, 231-236. Impact Factor: 4.784

50. Extraordinarily stable non-cubic structures of Au: A high pressure and temperature study, Mettela, G.; Yesudas, S. A.; Shukla, A.; Bellin, C.; Svitlyk, V.; Mezouar, M.; Narayana, C.; Kulkarni, G. U. *Chem. Mater.,* **2017,** 29, 1485-1489. Impact Factor: 9.466

51. Non-FCC rich Au crystallites exhibiting unusual catalytic activity, Mettela, G.; Mammen, N.; Joardar, J.; Narasimhan, S.; Kulkarni G. U. *Nano Res.,* **2017,** DOI:10.1007/s12274-017-1417-y. Impact Factor: 8.893

52. Self-assembling and luminescent properties of chiral bisoxadiazole derivatives in solution and liquid-crystalline phases, Sivadas, A.P.; Shankar Rao, D.S.; Kumar, N. S. S.; Prabhu, D. D.; Varghese, S.; Ramachandran, C. N.; Ongungal, R. M.; Prasad S.K.; Das, S. *J. Phys. Chem. B,* **2017,** 121, 1922. Impact Factor: 3.187.

53. Effect of pressure on dielectric and Frank elastic constants of a material exhibiting the twist bend nematic phase, Parthasarathi, S.; Rao, D.S.S.; Palakurthy, N.B.; Yelamaggad, C. V.; Prasad, S.K. *J. Phys. Chem. B,* **2017,** 121, 896. Impact Factor: 3.187

54. Dynamic orthogonal switching of a thermoresponsive self-organized helical superstructure, Zhang, L.; Wang, L. ; Hiremath, U. S.; Bisoyi, H. K.; Geetha G. Nair, Yelamaggad, C.V.; Urbas, A. M.; Bunning, T. J.; Li, Q. *Adv. Mater.,***2017,** DOI:10.1002/adma.201700676. Impact Factor: 18.960

55. Confined electroconvective and flexoelectric instabilities deep in the Freedericksz state of nematic CB7CB, Krishnamurthy, K. S.; .; Palakurthy, N.B.; Yelamaggad, C. V. *J. Phy. Chem. B.* **2017**. DOI: 10.1021/acs.jpcb.7b03072. Impact Factor: 3.187

56. Solvent driven polymorphism in Langmuir and Langmuir Schaefer film of poly(vinylidene fluoride), Kumar, C.; Viswanath, P.; *Euro. Poly. J.,* **2017,** 86, 132. Impact Factor: 3.485

57. Films of reduced graphene oxide with metal oxide nanoparticles formed at a liquid/liquid interface as reusable surface enhanced Raman scattering substrates for dyes, Bramhaiah, K.; Singh, V. N.; Kavitha, C.; John, N. S. *J. Nanosci. Nanotechnol.,* **2017,** 17, 2711-2719. Impact Factor: 1.5

58. Nanoscale conductance in lead phthalocyanine thin films: Influence of molecular packing and humidity, Madhuri, K. P.; Kaur, P.; Ali, Md. E.; John, N. S. *J. Phys. Chem. C,* **2017,** 121, 9249-9259. Impact Factor: IF: 4.536

59. Self-assembly and molecular packing in cholesteryl esters at interfaces, Sarkar, A.; Suresh, K.A. J. *Chem. Phys.,* **2017,** DOI :10.1063/1.4984119. Impact Factor: 2.894

60. Charge transport in mesogenic rod-like, disc-like and polymeric monolayers at air-solid interface, Suresh, K.A.; Gayathri, H. N. *Mol. Cryst. Liq. Cryst.,* **2017,** DOI:10.1080/15421406.2017.1287480. Impact Factor: 0.532.

61. Transforming a C3-Symmetrical Liquid Crystal to a π-Gelator by Alkoxy Chain Variation, A. Sandeep, V. K. Praveen, D. S. Shankar Rao, S. Krishna Prasad, and A. Ajayaghosh, *ACS Omega* (in Press) Substituted

62. Aroylhydrazone Based Polycatenars: Tuning of Liquid Crystalline Self-Assembly, H. K. Singh, B. Pradhan, S. K. Singh, R. Nandi, D.S. Shankar Rao, S. Krishna Prasad A. S. Achalkumar B. Singh, *Chemistry Select* (in Press)

63. Effect of ZnO nanoparticles on the morphology, dielectric, electro-optic and photo luminescence properties of a confined ferroelectric liquid crystal material, Divya Jayoti, Praveen Malik and S. Krishna Prasad, *Journal of Molecular Liquids* (in Press).

64. Instabilities in the electric Freedericksz state of the twist-bend nematic liquid crystal CB7CB. K. S., Krishnamurthy, Kanakala Madhu Babu, C. V. Yelamaggad, M. Kleman. *Soft Matter,* **2018,** DOI: 10.1039/C8SM00554K. IF 3.709

65. Negative differential resistance in nickel octabutoxy phthalocyanine and nickel octabutoxy phthalocyanine / graphene oxide ultrathin films, Arup Sarkar and K. A. Suresh, *Journal of Applied Physics,* **2018,** 123, 155501-7 https://doi.org/10.1063/1.5021719. IF 2.068

### In Conference Proceedings

1. Reduced Graphene oxide / Nanoparticle hybrid structures: A new generation smart materials for optical sensors, Kavitha, C., K, Bramhaiah., & John,Neena S.. *Materials Today: Proceedings 5,* **2018,** 2609–2618

2. 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)

### Technical Reports / Monographs / Books

1. S. Krishna Prasad and Geetha G. Nair, Update on "Nematic Liquid Crystals: Elastic Properties", in The Encyclopedia of Materials: Science and Technology, Reference Module in Materials Science and Materials Engineering, Eds. S. Mahfoudh and M. Nicholls (Elsevier Science Ltd., Amsterdam), **2017**

# ANNEXURE - B

## V4 Science Programme @ CeNS

| No. | Date | Institution Name & Address | Participation Details | | Topic |
|---|---|---|---|---|---|
| | | | Student | Staff | |
| 1. | 08.07. 2017 | BEL High School, BEL Campus, Jalahalli | 25 | 1 | Science of Colours and National Science Day |
| 2. | 22.07.2017 | National Public School, Rajajinagar | 24 | 2 | Nanoscience: The New and Big of Small |
| 3. | 19.08.2017 | Acharya B School 8th Mile, Peenya | 14 | 1 | Imaging Nanomaterials |
| 4. | 09.09.2017 | Bhavan School, Mysore Road, Chamarajpet, Bengaluru | 24 | 1 | Noble Prize Winning problems in chemistry |
| 5. | 03.11.2017 | Little Flower School, Attiguppe | 30 | 1 | Small Questions Big Answers |
| 6. | 02.12.2017 | Om Shree School, Hoskote | 30 | 4 | Noble Prize Winning problems in chemistry |
| 7. | 16.12.2017 | Angels High School, Vijayanagar | 40 | 2 | Solar Cells |
| 8. | 03.02.2018 | BEL - CBSE Jalahalli | 53 | 3 | Small Cause- Large Effect - Soft Matter |
| 9. | 28.02.2018 | Naviks School | 30 | 2 | National Science Day |
| 10. | 23.03.2018 | Nano for Youth for college students | 354 | 24 | * The Big Story of Small Things<br>*Swiss Cheese and Rollabe displays<br>*Learning Nanotechnology from nature<br>* Nature-Inspired tissue engineering |

## V4 Science Programme @ your Institution

| No. | Date | Institution Name & Address | Participation Details | | Topic |
|---|---|---|---|---|---|
| | | | Student | Staff | |
| 1. | 20.07.2016 | Dr N Shankar Adhynthaya Memorial Senior Secondary School, Nitte , Karkala | 180 | 6 | The Occurrence of Different States of Matters and their Unique Characteristics |
| 2. | 22.07.2017 | Shanthiniketan Public School, Ramanagara | 210 | 10 | Glimpses of Nano World or Namage Beku Nano |
| 3. | | | | | Visible and Invisible Light |
| 4. | 02.08.2017 | JCBM College, Sringeri | 200 | 4 | Graphene : The material that changed the world |
| 5. | | | | | Nanomaterials for solar cells |
| 6. | | | | | Smart Windows |
| 7. | | | | | Electromagnetic Sheilding: Materials |
| 8. | 18.08.2017 | Shri Jagadguru Fakirashivayogi High School, Saumshi | 250 | 8 | Science of Invisibility |
| 9. | 10.11.2017 | Om Shree School, Hoskote | 400 | 5 | Science of Invisibility |
| 10. | 14.11.2017 | Bangalore Institute of Technology, Bangalore | 300 | 3 | Science of Invisibility |
| 11. | 10.11.2017 | Indira Gandhi National Tribal University (IGNTU), Amarkantak, (M.P.) | 400 | 5 | Science of Invisibility |

# ANNEXURE - C

| Sl. No. | Name of ROI student | Name of the Parent Institute | Mentor |
|---|---|---|---|
| 1. | Ms. Veena S. G. | MIT, Manipal | Prof. G. U. Kulkarni |
| 2. | Mr. Muhammed Safeer | Farook College, Kerala | Dr. Neena S. John |
| 3. | Mr. Nitesh | IIT-Bombay | Dr. Veena Prasad |
| 4. | Ms. Laxmi Kanta Singh | IIT-Bombay | Dr. Pralay K. Santra |
| 5. | Mr. Dheeraj | IIT-Bombay | Dr. H.S.S.R. Matte |
| 6. | Mr. Vaibhav Pal | IISER, Mohali | Dr. S. Krishna Prasad |
| 7. | Ms. Anna Maria Dominic | IISER-TVM | Dr. Pralay K. Santra |
| 8. | Mr. Sabarigresan | Central University of Tamil Nadu | Dr. S. Angappane |
| 9. | Mr. Goutam P. | Mangalagangothri, Mangalore University | Dr. K.S. Subrahmanyam |
| 10. | Ms. Tarangini K. S. | Mangalagangothri, Mangalore University | Dr. Veena Prasad |
| 11. | Mr. Karthik Chandra | Mangalagangothri, Mangalore University | Dr. P. Viswanath |
| 12. | Mr. Sundram Pandey | Manasagangothri, University of Mysore | Dr. H.S.S.R. Matte |
| 13. | Ms. Aruna N. Nair | IISER, TVM | Dr. Neena S. John |
| 14. | Mr. Sagar Arora | Manasagangothri, University of Mysore | Dr. H.S.S.R. Matte |
| 15. | Ms. Satyaswini Sahoo | Central University of Karnataka, Gulbarga | Dr. Geetha G. Nair |
| 16. | Mr. Hiran J. Lal | MIT, Manipal | Dr. S. Angappane |
| 17. | Ms. Ranjitha A. P. | The National College, Jayanagar, Bangalore | Dr. S. Krishna Prasad |
| 18. | Ms. Aruna Shree K. P. | JBC Bangalore University, Bangalore | Dr. C. V. Yelamaggad |
| 19. | Mr. Rahul M. | Amrita Vishwa Vidyapeeetham University, Tamil Nadu | Prof. G. U. Kulkarni |
| 20. | Mr. Hitesh Khanna | Amity University, Uttar Pradesh | Dr. K.S. Subrahmanyam |
| 21. | Mr. Sahibzada Roohan Farooq Lala | Manasagangothri, University of Mysore | Dr. Pralay K. Santra |
| 22. | Mr. Sumit Kumar | Manasagangothri, University of Mysore | Dr. H.S.S.R. Matte |
| 23. | Mr. Anamitra Ganguli | St. Xavier's College, Kolkata | Dr. Neena S. John |
| 24. | Mr. Nijhil S. | Manipal University (MIT), Manipal | Dr. D. S. Shankar Rao |


नैनो एवं मृदु पदार्थ विज्ञान केंद्र
विज्ञान एवं प्रौद्योगिकी विभाग, भारत सरकार के अधीन एक स्वायत संस्था
CENTRE FOR NANO AND SOFT MATTER SCIENCES
Autonomous Institute under the Dept. of Science and Technology, Govt. of India

Prof. U R Rao Road, Jalahalli, Bengaluru 560 013