# Prof. (Dr.) Nandakumar Kalarikkal

*Director*

*International and Inter University Centre for Nanoscience and Nanotechnology*

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*Director & Chair*

*School of Pure and Applied Physics*

*&*

*Director-in-Charge*

*School of Nanoscience and Nanotechnology*

*&*

*Member IQAC, Ex-Member Senate*

***Mahatma Gandhi University***

***Kottayam - 686 560, Kerala, India***

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## Personal Data

Date of birth : 30th May 1964

Nationality : Indian

Gender : Male

## Education

**M. Sc** (*Master of Science*), **Industrial Physics**
Cochin University of Science & Technology, Kerala, India

**Ph. D** (*Doctor of Philosophy*), **Semiconductor Physics**
Cochin University of Science & Technology, Kerala, India

Thesis title: ***"Optical and thermal properties of selected ternary amorphous semiconductors".***

**Postdoctoral Fellow**
CSIR-National Institute for Interdisciplinary Science and Technology, Thiruvananthapuram, Kerala, India

## Academic positions

**Faculty at MGU**
Permanent faculty in the School of Pure and Applied Physics of Mahatma Gandhi University since 1994. Presently the Director and Chair.
More than 25 years of teaching and more than 30 years of research experience.

**Joint Director & Director of IIUCNN**
From 2009-2017, Joint Director of the International and Inter University Centre for Nanoscience and Nanotechnology since the inception of the Centre

Since 2018, Director of IIUCNN

## Recognition

- Professor@Lorraine, University of Lorraine, France
- CNRS Professor-Université Claude Bernard LYON I – CNRS, France
- Visiting Professor, University of Lorraine & Institute of Jean lamour, Nancy, France
- Visiting Professor in Stockholm University-Sweden, Jozef Stefan Institute-Slovenia, Slovakian Academia Veid-Slovakia
- Visiting Fellow, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, India
- Guest Scientist, Leibniz-Institut fur Polymerforschung Dresden, Germany
- Visiting Fellow, Gulbarga University, Gulbarga, Karnataka under SAP scheme of UGC
- Visiting Professor, Alemaya University (1998-2002) & Mekkele University (2006-2007), Ethiopia
- Conference Fellowship Award of the Seventh International Conference on Phonon Scattering in Condensed Matter held at Cornell University, USA
- Research Associate Fellowship from DST & CSIR, Govt. of India (1992)
- Senior Research Fellowship from CSIR, Govt. of India (1990)
- Junior Research Fellowship from Department of Atomic Energy, Govt. of India (1987)

## Publications in 2020 up to June

1. Rajakumari, R., Volova, T., Samuel Oluwafemi, O., Thomas, S., & **Kalarikkal, N**. (2020), Transformation of essential minerals into tablet formulation with enhanced stability, Advanced Powder Technology, doi:10.1016/j.apt.2020.05.008
2. Davis, B. A., Chakraborty, B., **Kalarikkal, N.**, & Ramaniah, L. M. (2020), Room Temperature Ferromagnetism in Carbon Doped MoO3 for Spintronic Applications: A DFT Study, Journal of Magnetism and Magnetic Materials, Volume 502, 15 May 2020, 166503 , doi:10.1016/j.jmmm.2020.166503 .
3. Joshy K.S., Jiya Jose, Tianduo Li, Merlin Thomas, Aruna M. Shankregowda, Sreejith Sreekumaran, **Nandakumar Kalarikkal**, Sabu Thomas. (2020). Application of novel zinc oxide reinforced xanthan gum hybrid system for edible coatings, International Journal of Biological Macromolecules, Volume 151, 15 May 2020, Pages 806-813, . doi:10.1016/j.ijbiomac.2020.02.085
4. Anshida Mayeen, M.S. Kala, S. Sunija, Didier Rouxel, R.N. Bhowmik, Sabu Thomas, **Nandakumar Kalarikkal**, Flexible dopamine-functionalized BaTiO3/BaTiZrO3/BaZrO3-PVDF ferroelectric nanofibers for electrical energy storage, Journal of Alloys and Compounds, Volume 837,2020,155492,ISSN 0925-8388,https://doi.org/10.1016/j.jallcom.2020.155492.
5. K.R. Rakhimol, Sabu Thomas, **Nandakumar Kalarikkal**, K. Jayachandran, Casein mediated synthesis of stabilized metal/metal-oxide nanoparticles with varied surface morphology through pH alteration,Materials Chemistry and Physics, Volume 246,2020,122803,ISSN 02540584,https://doi.org/10.1016/ j.matchemphys.2020.122803.
6. K.S. Joshy, Robin Augustine, Tianduo Li, S. Snigdha, Anwarul Hasan, CibyKomalan, **Nandakumar Kalarikkal**, Sabu Thomas,Carboxymethylcellulose hybrid nanodispersions for edible coatings with potential anti-cancer properties, International Journal of Biological Macromolecules, Volume 157,2020, Pages 350-358,ISSN 0141-8130,https://doi.org/10.1016/j.ijbiomac.2020.04.175.
7. Ghosal, K., Adak, S., Agatemor, C, **Nandakumar Kalarikkal**, et al. Novel interpenetrating polymeric network based microbeads for delivery of poorly water soluble drug. J Polym Res **27,** 98 (2020). https://doi.org/10.1007/s10965-020-02077-6
8. Sandhya, P. K., Sreekala, M. S., Xian, G., Padmanabhan, M., **Kalarikkal, N.**, & Thomas, S. (2020), Viscoelastic and electrical properties of RGO reinforced phenol formaldehyde nanocomposites. Journal of Applied Polymer Science, 49211. doi:10.1002/app.49211
9. Kanchan Upadhyay, Sabu Thomas, **Nandakumar Kalarikkal**, Raunak Kumar Tamrakar, Tunning of photoluminescence emission of Y2SiO5:Tb3+, Eu3+ phosphors by altering the Tb3+, Eu3+ ratio, Materials Today: Proceedings,2020,ISSN 2214-7853,https://doi.org/10.1016/j.matpr.2020.03.095.
10. Ramani Thekkathu, Devika Ashok, Pravisha K Ramkollath, Sandhyarani Neelakandapillai, Leon Prasanth Kurishunkal, M.S. Priyanka Yadav, **Nandakumar Kalarikkal**, Magnetically recoverable Ir/IrO2@Fe3O4 core/ SiO2 shell catalyst for the reduction of organic pollutants in water, Chemical Physics Letters, Volume 742, 2020,137147, ISSN 0009-2614,https://doi.org/10.1016/j.cplett.2020.137147.

11. K. Shalini, Seethal Pappachan, Anshida Mayeen, **Nandakumar Kalarikkal**, N.V. Giridharan, Strengthened magnetoelectric multiferroic response in (K0.5Na0.5[Nb1-xFex/2Mnx/2]O3) ceramics, Materials Letters, Volume 261,2020,126988,ISSN 0167-577X,https://doi.org/10.1016/j.matlet.2019.126988.
12. Sandhya Gopalakrishnan, Aby Mathew T., Miran Mozetič, Jayachandran V. P., Jiya Jose, Sabu Thomas & **Nandakumar Kalarikkal** (2020), Development of biocompatible and biofilm-resistant silver-poly(methylmethacrylate) nanocomposites for stomatognathic rehabilitation, International Journal of Polymeric Materials and Polymeric Biomaterials, 69:3, 186-199, DOI: 10.1080/00914037.2018.1552863
13. Thomas, M. S., Pillai, P. K. S., Faria, M., Cordeiro, N., Kailas, L., **Kalarikkal, N.**, … Pothen, L. A. (2020), Polylactic acid/nano chitosan composite fibers and their morphological, physical characterization for the removal of cadmium(II) from water, Journal of Applied Polymer Science, 48993.
14. Preethy Augustine, Y. Narayana, Nandakumar Kalarikkal, Influence of spinel ferrites in the modification of magneto-electric coupling effect in BiFeO3, Materials Today: Proceedings, Volume 25, Part 2,2020,Pages 208-212,ISSN 2214-7853,https://doi.org/10.1016/j.matpr.2020.01.031.
15. Jincemon Cyriac, Jilu C. John, **Nandakumar Kalarikkal**, Saji Augustine, Tailoring the dielectric and magnetic properties of Eu-substituted BiFeO3 nanoparticles, Materials Today: Proceedings, Volume 25, Part 2,2020, Pages 134-139,ISSN 2214-7853,https://doi.org/10.1016/j.matpr.2019.12.186.
16. Ann Rose Abraham, B. Raneesh, P. M. G. Nambissan, D. Sanyal, Sabu Thomas & **Nandakumar Kalarikkal** (2020), Defects characterisation and studies of structural properties of sol–gel synthesised $MgFe_2O_4$ nanocrystals through positron annihilation and supportive spectroscopic methods, Philosophical Magazine, 100:1, 32-61, DOI: 10.1080/14786435.2019.1668576
17. Russier-Antoine, I., Fakhoury, H., Basu, S., Bertorelle, F., Dugourd, P., Brevet, P.-F., **Nandakumar Kalarikkal**, Antoine, R. (2020)., Second Harmonic Scattering from Mass Characterized 2D Graphene Oxide Sheets, Chemical Communications. Issue 27, doi:10.1039/d0cc00111b
18. Jose, P.P.A., Kala, M.S., Joseph, A.V., **Nandakumar Kalarkkal** et al., Reduced graphene oxide/silver nanohybrid as a multifunctional material for antibacterial, anticancer, and SERS applications., Appl. Phys. A **126,** 58 (2020). https://doi.org/10.1007/s00339-019-3237-x
19. Rose Abraham, A., b, Raneesh, Sanyal, D., Thomas, S., **Kalarikkal, N**., & Nambissan, P. M. G. (2020), Defects-focused analysis of calcium-substitution-induced structural transformation of magnesium ferrite nanocrystals. New Journal of Chemistry, Issue 4, doi:10.1039/c9nj04068d
20. Vijayamma, R., **Kalarikkal, N.**, & Thomas, S. (2020), Layered double hydroxide based nanocomposites for biomedical applications, Polymer Nanocomposites, 677–714. doi:10.1016/b978-0-08-101903-0.00016-7

21. Somasekharan, L., Xavier, P., Bose, S., Zachariah, A. K., **Kalarikkal, N.**, Anil Kumar, S., & Thomas, S. (2019). Natural rubber nanocomposites with MWCNT@POSS hybrid filler: Preparation and properties, Polymer Composites. doi:10.1002/pc.25376
22. Rajendran Rajakumari, Tatiana Volova, Oluwatobi Samuel Oluwafemi, S Rajeshkumar, Sabu Thomas, **Nandakumar Kalarikkal**, Nano formulated proanthocyanidins as an effective wound healing component, Materials Science and Engineering: C, Volume 106,2020,110056,ISSN 0928-4931,https://doi.org/10.1016/j.msec.2019.110056.
23. Arunima Reghunadhan, Janusz Datta, Maciej Jaroszewski, **Nandakumar Kalarikkal**, Sabu Thomas, Polyurethane glycolysate from industrial waste recycling to develop low dielectric constant, thermally stable materials suitable for the electronics, Arabian Journal of Chemistry, Volume 13, Issue 1, 2020, 2110-2120, ISSN 1878-5352, https://doi.org/10.1016/j.arabjc.2018.03.012.
24. Avinash R. Pai, T.Binumol, Daniel Pasquini, Bastien Seantier, **Nandakumar Kalarikkal**, SabuThomas, Ultra-Fast Heat Dissipating Aerogels Derived from Polyaniline Anchored Cellulose Nanofibers as Sustainable Microwave Absorbers, Carbohydrate Polymers, (2020) https://doi.org/10.1016/j.carbpol.2020.116663

**Total Number of publications : 200+**

**Projects completed : 09**

**Projects Ongoing : 10 (3-National,3-International, 4-SPARC)**

**No of Books edited : 22**

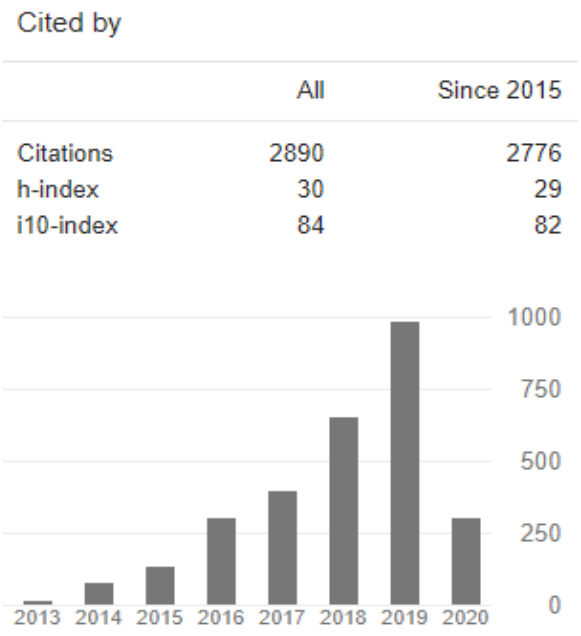
**No of Books Chapters : 20**

**Number of Ph. Ds Supervised : 20**

**Number of M. Phil and M.Sc. theses Supervised : 30**

Google scholar profile

Books



## Research Grants

### National:

- Irradiation effects on the structural and electrical properties of selected ferroelectric ceramics, NSC-UFUP project-IAC-Govt. of India-(**Principal Investigator**)-Completed
- Nano Materials: Synthesis, characterization and applications, DST, New Delhi (**Principal Co-Investigator**)-Completed
- Ion beam irradiation effects on the structural and ferroic properties of selected sol-gel derived films of nanomultiferroics-UGC-DAE-CSR Kolkata Centre Project- (**Principal Investigator**)-Completed
- Development of engineered nano-structured materials for high performance applications-DST-Nano Mission-Govt. of India-(**Principal Co-Investigator**)-Completed
- Development of Multi Walled Carbon Nanotube Filled Polycarbonate/ Polypropylene Double Percolating Conductive Polymer Blend Nanocomposites for Electromagnetic Interference Shielding Gaskets for Mobile Phones.–DIT-New Delhi-**(Principal Co-Investigator**)-Completed
- Development of super tough nanocomposites from epoxy resin, liquid rubber and nanoclay, Kerala State Council for Science, Technology and Environment (KSCSTE under the SARD program-**On going**-(**Project Co-Investigator**)
- Nanoparticle aggregation behavior in polymer nanocomposites- UGC-DAE-CSR Kolkata Centre Project-**On going** -(**Principal Investigator**)
- Development of one dimensional multiferroic nanocomposites for device applications" under the SRS scheme- KSCSTE-Govt. of Kerala-**Completed**-(**Principal Investigator**)
- Physics of Cavitation Bubbles and Hydrogen Generation during Liquid Phase Laser Ablation-BRNS/BRFST-DAE-Govt. of India-**On going**- (**Principal Investigator**)
- Design and applications of magnetically responsive self-assembled polymer nanocomposites, DST-Nano Mission-Govt. of India-**Ongoing**-(**Principal Investigator**)
- Heavy Ion/Gamma Ray Engineered Vertically Oriented Graphene Hybrid Systems for Environmental Remediation, Supported by UGC DAE Kolkata Centre under the CSR Scheme-**Ongoing- (Principal Investigator)**

### International:

- Biobased Scaffolds, Membranes and Hydrogels for Improved Wound Healing and Bone Regeneration (BIOHEAL)-Swedish Research Link Grant in collaboration with Prof. Aji Mathew, *University of Stockholm, Swedan*
- Advanced Nanocomposites for Micro and Nanosensors Applications-under the PICS scheme with Prof. Didier ROUXEL, *Institut Jean Lamour* - UMR CNRS n°7198 - *Université de Lorraine*- BP 70239 - 54506 Vandœuvre-lès-Nancy Cedex – *France*

## SPARC projects:

- **Project Title: Bio-filler-Interfaced Electrospun PVDF Hybrid Piezoelectric Generator for Mechanical Energy Harvesting**

  **Indian PI :** Dr. Nandakumar Kalarikkal (Mahatma Gandhi University)

  **Indian Co-PI(s) :** Prof. Sabu Thomas (Mahatma Gandhi University)

  **International PI :** Dr. Bruno Ameduri (UNIVERSITÉ DE MONTPELLIER)

  **International Co-PI(s) :** Prof. Didier Rouxel (UniversitÃ© de Lorraine, France)

  **Sanctioned Budget: Rs. 78,93,348.00/-**

- **Project Title: Study of urea oxidation electrocatalysis for energy conversion from waste**

  **Indian PI :** Dr. Nandakumar Kalarikkal (Mahatma Gandhi University)

  **Indian Co-PI(s) :** Prof. Sabu Thomas (Mahatma Gandhi University)

  **International PI :** Prof. Dan Meyerstein (BEN GURION UNIVERSITY OF THE NEGEV)

  **International Co-PI(s) :** Prof. Alex Schechter (Ariel University)

  **Sanctioned Budget: Rs. 66,69,785.00/-**

- **Project Title: Vachellia nilotica based biocompatible hybrid nanostructured coatings/films for seeds and fruits**

  **Indian PI :** Dr. Nandakumar Kalarikkal (Mahatma Gandhi University)

  **Indian Co-PI(s) :** Prof. Sabu Thomas (Mahatma Gandhi University)

  **International PI :** Dr. K.P. Sandeep (NORTH CAROLINA STATE UNIVERSITY)

  **International Co-PI(s) :** Dr. Sajid Alavi (Kansas State University )

  **Sanctioned Budget: Rs. 66,30,385.00/-**

- **Project Title: Nanoscale contrast agents for diagnostic biomedical imaging**

  **Indian PI :** Dr. Nandakumar Kalarikkal (Mahatma Gandhi University)

  **Indian Co-PI(s) :** Prof. Sabu Thomas (Mahatma Gandhi University)

  **International PI :** Dr. Murukeshan Vadakke Matham (NANYANG TECHNOLOGICAL UNIVERSITY (NTU))

  **International Co-PI(s) :** Dr. Parasuraman Padmanabhan (NANYANG TECHNOLOGICAL UNIVERSITY (NTU))

  **Sanctioned Budget Details: Rs. 59,88,299.00/-**

## Patents

1. **'A Polymer Nanocomposite, Process and Application there-of'**, WIPO Publication number: WO2016142848 A1, Publication date: Sep 15, 2016, Indian patent Application No: 638/DEL/2015 Mohammed Arif P, Sabu Thomas, **Nandakumar Kalarikkal.**

2. New Poly(trimethylene terephthalate) based nanocomposite formulation for EMI Shielding, patent filed TEMP/E-1/4093/2018-CHE; Aswathi M.K, Ajitha A.R ,Sabu Thomas, **Nandakumar Kalarikkal**, M. Padmanabhan, Lovely P. Mathew
3. MWCNTs reinforced polymer blend nanocomposite for EMI shielding application, patent filed TEMP/E-1/4102/2018-CHE**,** Ajitha A R, Aswathi M K, Sabu Thomas, **Nandakumar Kalarikkal**, Geethamma V G
4. A low density silicon rubber based EMI shielding for composite preparation, patent filed; Avinash R Pai, Sabu Thomas, **Nandakumar Kalarikkal**

## Membership in Professional bodies

- The Indian Physics Association- Life Membership
- Plasma Science Society of India-Life Membership
- Academy of Physics Teachers- Annual

## Research Collaborations

- Bhabha Atomic Research Centre, Mumbai, India
- Raman Research Institute, Bangalore, India
- Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, India
- Saha Institute of Nuclear Physics, Kolkata, India
- UGC-DAE Consortium for Scientific Research-Kolkata Centre, Kolkata, India
- Cochin University of Science & Technology, Kochi, India
- Inter University Accelerator Centre, New Delhi, India
- Central University, Kannur, Kerala, India
- Indian Institute of Science, Bangalore, Karnataka, India
- Indian Institute of Tropical Meteorology, Pune, India
- Walter Sisulu University, South Africa
- Johannesburg University, South Africa
- Jožef Stefan Institute, Ljubjana, Slovenia
- Uninversity of Technology- MARA, Malaysia
- University of Lorraine & Institute of Jean Lamour, France
- University of South Brittany, Lorrient, France
- Kansas State University, USA
- North Carolina State University, USA
- Deakin University, Australia
- Stockholm University, Sweden
- Claude Bernard University Lyon, France
- Ariel University, Israel
- Ben Gurion University of the Negev, Israel
- Nanyang Technological University, Singapore
- University of Montepellier, France

## Teaching areas

- Materials Science/Solid State Physics, Quantum Optics, Statistical Physics, Quantum Mechanics, Classical Mechanics, Physics of Nanomaterials, Mesoscopic Physics, Introduction to Nanoscience and Nanotechnology (Open Course), Experimental Physics, Nanophotonics

## Research Areas

The research works of my group include the Nanostructured materials and applications, LASER Plasma, Non-liner optics, Pulsed laser deposition, LIBS for forensic sciences, Ion irradiation effects on various novel materials, Climate change, Tissue engineering, Nanodentistry and Phase transitions. The different topics of current research works are:

- **Nanomultiferroics**

  In this class of materials we are synthesizing various systems such as R-$CrO_3$, R-$MnO_3$ and R-$Fe_2O_4$ where R could be Ho, Er, Tm, Yb, Lu or Y. The samples are prepared mainly through sol-gel route and characterized for their structural, multiferroic, linear and nonlinear optical properties using TGA/DTA, XRD, SEM, HRTEM, FTIR spectroscopy, Dielectric spectroscopy, VSM, UV-Vis-NIR spectroscopy, Photoluminescence spectroscopy and Z-scan technique. The thermal parameters such as heat capacity, thermal conductivity and thermal diffusivity are also investigated near the multiferroic transitions. The synthesis and multiferroic coupling of composite nano/multiferroics are also a thrust area of the group.
- **Nanosemiconductors and Nanophosphors**

  In this class of materials we concentrate on quantum dots, metal oxides and $Sr_2CeO_4$ type materials. The materials are prepared through novel green synthesis routes and sol-gel method and characterized for their various properties. The potential uses of these materials are being explored in different fields which include water purification, sensing and lighting applications.
- **Nanocomposites**

  Under this class of materials various metal, metal oxide, carbon structures (grapheme and CNT), magnetic particles and quantum dot filled polymer nanocomposite materials are prepared using various chemical routes. The interfacial effects of the as prepared nanocomposites are also a thrust area for the group.
- **Nanoferroelectrics**

  Under this class, we are mainly concentrating on relaxor type of ferroelectrics such as Strontium Barium Niobate systems and the effect of rare earth ion doping on the linear and nonlinear optical properties. The samples are being characterized for various properties using sophisticated techniques. The phase transitions in this class of materials are also investigated in detail.
- **Nanoferrites**

  Different nanostructured spinel ferrite systems have been prepared using sol-gel technique and their structural, magnetic, electrical, linear and nonlinear optical

properties are investigated. Various systems such as $NiFe_2O_4$, $CoFe_2O_4$, $ZnFe_2O_4$ and mixed compositions of these ferrites have been synthesized and their various physical properties are investigated. The water soluble nanoferrites are also of potential interest to the group.

- **Nanomedicine**

  Under this area, we are mainly concentrating on the preparation and characterization of Polymer based scaffolds for biomedical applications. New hybrid polymer nanocomposites for dental applications are also a thrust of our group.

- **Nanosensors**

  The various nanomaterials synthesized in the laboratory are explored for different sensing applications which include nanoparticles incorporated membranes for bio-sensing and water purification applications.

- **Ion beam irradiation effects & Phase transitions**

  Heavy ion beam irradiation effects on the structural and multiferroic properties of sol-gel derived films of selected nanomultiferroic films are investigated under this category. The studies on the phase transitions of bulk and nanomaterials are also investigated using different techniques.

- **2D Hybrid structures**

  Different 2D hybrid materials such as Graphene oxide, $MoS_2$, $WS_2$ with noble metal nanostructures are explored for energy, water splitting, NLO applications

- **Climate Change**

  Aerosol samples collected from urban and semi urban areas of Indian subcontinent are analyzed for chemical characteristics and effects on climatic conditions and atmospheric pollution. Single particle analysis of airborne samples from different altitudes of *Indo Gangetic Planes* and eastern metropolitan areas for source approximation and climate modeling, and cloud seeding are of current interest.

- **Water**

  Development of hybrid materials for water purification, Photocatalysts for degradation of pesticides and herbicides, Biosensors for detection of pathogens and antibiotics in water bodies

- **Laser Physics**

  Plasma-Cavitation and Bubbling, Non-linear Optics (NLO) and Pulsed Laser Deposition (PLD) of thin films, LIBS for Forensic Sciences with Kerala Police Academy

## Facilities available

A very good wet chemistry synthesis laboratory with major infrastructure facilities such as Furnaces, Centrifuge, Magnetic stirrers, pH meters, Hot air ovens, Microwave oven, Pelletizer, Ultrsonicator and Spin Coaters, Nanobiology with facility for antibacterial studies, Nd:YAG LASER for PLD, Laser Plasma and Non linear optical studies , He-Ne LASER, Quadrant Detector, CCD and IICCD Camera.

For experimental characterizations, Dielectric and resistivity measurement facilities from 77K to 773K, UV-Vis_NIR spectrophotometer, Spectrophotoflourimeter with life time measurement facility, X-ray diffractometer, Single Crystal X-ray diffractometer, ME coupling measurement unit, AFM, HRTEM , Electrospinning Unit, VSM are available.

SEM, Confocal Raman with AFM, GCMS etc. are available as Central facilities of the University

## Conferences /Workshops/Seminars Convened: 25

## Other information

External examiner for M. Sc, M. Phil and Ph. D theses evaluator for various Universities in India and abroad. Resource person for many workshops and seminars organized by different colleges, refresher courses, national and international workshops/conferences organized by School of Pure and Applied Physics, International and Inter University Centre for Nanoscience and Nanotechnology of Mahatma Gandhi University and other institutions in India and abroad. Reviewer for many international journals.

## Hobbies

Music, classical art forms, reading, movies, travel, photography, videography, cooking, gardening and bird watching