

## Dr. V KUMAR

Former Director &

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CENTRE FOR MATERIALS FOR ELECTRONICS TECHNOLOGY[C-MET]

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Date of birth: 28.07.1962

### Education

Ph.D (Chemistry) Indian Institute of Technology, Madras-1990

M.Sc. (Chemistry) Central University, Hyderabad-1985

### Professional experience – Research

#### Scientist-G

Jan, 1991 – 31 July, .2022

Centre for Materials for Electronics Technology[C-MET], Trissur

### Major Research interests

- Piezoelectrics for PiezoMEMS applications like micro actuators, sensors and energy harvesting
- Design of Materials for achieving enhanced performance and improved device reliability.
- Structure-property correlations.

### Research Publications & Patents

93. Pseudo-tetragonality and its influence on the polarization switching behaviour in the antiferroelectric system  $\text{Pb}(\text{Zr}_{1-x-y}\text{Sn}_x\text{Ti}_y)\text{O}_3$ , Anil Adukkadan, Sujoy Saha, Niranjan Lalla, Rajeev Ranjan and Kumar Viswanathan, *J.Mater.Chem. C*(under review)
92. New insights into stabilization of tetragonal phase in donor-acceptor co-doped  $\text{BaTiO}_3$ , J.P. Jumana, A.Anil and V.Kumar, *Appl.Phys.A* 128,837(2022)
91. Transverse piezoelectric properties of preferentially {110}-oriented  $(\text{Pb}_{1-x}\text{Sr}_x)(\text{Zr}_{0.80}\text{Ti}_{0.20})\text{O}_3$  thin films, V.Priyadarsini,Athul Pradeep, A.Choudhary, V.Kumar, Takumi Nishikado, Kouta Onishi and Isaku Kanno, *Integr. Ferroelectrics* (accepted for publication)
90. Energy storage characteristics of novel antiferroelectric compositions, A.Chowdhary,V.Priyadarsini,Varna.V.Nair,Athul Pradeep,J.P.Jumana and V.Kumar *J. Alloys Compd.*,899,163395(2022)
89. Engineering Nanocrystalline Titania thin films for high photocatalytic activity , K.Vijila, K.V.Baiju and V.Kumar, *Materials Today Proceedings*,9,621(2019)
88. Role of Defect Structures in Stabilization of Ferroelectric Phase in Tin-Substituted Lead Zirconate Titanate, A.Anil, K.Vani and V.Kumar, *J.Amer.Ceram.Soc*, 101,3377-3382(2018)

87. Transverse Piezoelectric properties of {110}-oriented PLZT thin films, S.Laxmi Priya, V.Kumar, Takuya Teramoto and Isaku Kanno **Integr. Ferroelectrics**, 192(1),113-120(2018)
86. Enhanced electrostrain in Copper-doped Barium Strontium Titanate, K.Vani, A.Anil and V.Kumar, **Ferroelectrics** 550,136-140(2019)
85. Influence of Zr/Sn ratio on the Transverse Piezoelectric Coefficient  $e_{(31,f)}$  in Lanthanum doped Lead Zirconate Titanate Stannate Thin Films, S.Laxmi priya, V. Kumar and Isaku Kanno **Integr. Ferroelectrics** 201,86(2019)
84. Manganese doped BaTiO<sub>3</sub> nanotube arrays for enhanced visible-light photocatalytic applications, N.Manoj and V.Kumar, **Mat.Chem.Phys**,213,400-405(2018)
83. Stability studies of CdS sensitized TiO<sub>2</sub> nanotubes prepared using the SILAR method, K.Vijila, K.Baiju Vijayan and V.Kumar, **J.Environ.Chem.Engg**, 6,1404-1413(2018)
82. Influence of A-site Sr<sup>2+</sup> substitution on structure, dielectric and ferroelectric characteristics of 0.66[Pb(In<sub>0.50</sub>Nb<sub>0.50</sub>)O<sub>3</sub>]-0.34[PbTiO<sub>3</sub>], A.S.Divya, P.Juairiya, A. Anil, K.Vani and V.Kumar, **Ceram.Intl**,43,825-829(2017)
81. Influence of defects on the photocatalytic activity of Niobium-doped ZnO nanoparticles,M.K. Satheesan and V.Kumar, **J.Mater.Sci:Mater.Electron**,28, 4719-4724(2017)
80. SnO<sub>2</sub>-loaded BaTiO<sub>3</sub> nanotube arrays: fabrication and visible-light photocatalytic application, N.Manoj, A.B.Shalet and V.Kumar,**J.Mater.Sci: Mater.Electron**, 28,9770-9776(2017)
79. Room temperature ferromagnetism and red shift of band gap in Mn<sup>2+</sup>,Mg<sup>2+</sup>- codoped ZnO nanoparticles, M.K.Satheesan and V.Kumar, **J.Mater.Sci. Mater.Electron**, 27,17601-17605(2017)
78. Acceptor-defect mediated room temperature ferromagnetism in (Mn<sup>2+</sup>,Nb<sup>5+</sup>) co-doped ZnO nanoparticles, M.K. Satheesan, K.Vani and V.Kumar, **Ceram .Intl**,43, 8098-8102(2017))
77. Local structural rearrangements and evolution of Relaxor state in the complex perovskite (Ba<sub>1-x</sub>Pb<sub>x</sub>)(In<sub>0.50</sub>Nb<sub>0.50</sub>)O<sub>3</sub>, A.Anil and V.Kumar, **J.Amer.Ceram. Soc**, 99, 3980--3984(2016)
76. Influence of defect structure on Ferroelectric aging in donor-acceptor hybrid doped PZT, A.Anil and V.Kumar, **Appl. Phys. A**,122,581(2016)
75. Heteroepitaxial growth of phase-pure Lead indium niobate, A.S.Divya and V. Kumar, **Ceram.Intl**,42,12385(2016)
74. Composition dependence of Transverse Piezoelectric properties of preferentially {110}-oriented (1-x) PIN-x PT thin films, S. Laxmipriya, V. Kumar, Shogo Nishio and Isaku Kanno, **J. Alloys Compd**,688,863-867(2016)
73. Improved transverse piezoelectric properties in {110}-oriented B-site acceptor doped PLZT(8/65/35) thin films, S. Laxmipriya, V. Kumar, Shogo Nishio and Isaku Kanno, **Integr.Ferroelectrics**,176,210-219(2016)
72. Pd loaded TiO<sub>2</sub> nanotubes for the effective catalytic reduction of p-nitrophenol, C.M.Divya, K.Vijila, Wilfried Wunderlich, Suresh Pillai, Steven Hinder and V.Kumar, **Cat.Lett**,146,474-82(2016)
71. Titania Nanotube Arrays surface- modified with ZnO for enhanced photocatalytic applications, N.Manoj, K.Vijila, K.V.Baiju and V.Kumar, **Mat.Res.Bull**,77,35-40(2016)
70. Influence of lithium doping on the correlated ferromagnetic ordering and red shift of band gap in weakly Mn-doped ZnO nanoparticles, M.K. Satheesan and V.Kumar, **J.Mater.Sci:Mater.Electron**,27,6522(2016)
69. Stability studies of PbS sensitised TiO<sub>2</sub> nanotube arrays for visible light photocatalytic applications by X-ray Photo electron spectroscopy, N. B. Rahna, K. Vijila, N. Manoj, S.C.Pillai, S.J.Hinder, V.Kumar, K.V.Baiju, **Mat. Sci. Semicond.Process**,42(3), 303-310(2016)

68. Influence of Fe<sup>3+</sup> substitution on the dielectric and ferroelectric characteristics of Lead Indium Niobate, A.S. Divya and V.Kumar, **J.Alloys Compd**, 637,426-430(2015)
67. Evolution of Dielectric and Ferroelectric Relaxor States in Al<sup>3+</sup>-doped BaTiO<sub>3</sub>, K. Vani and V.Kumar, **AIP Advances**,5,027135(2015)
66. Transverse piezoelectric properties of {100}-oriented PLZT[x/65/35] thin films, S.Laxmipriya, V.Kumar, Fumiya Kurokawa and Isaku Kanno, **Mat.Chem.and Phys**,151,308(2015)
65. Influence of Lithium doping on orange emission in Mn.-doped ZnO, T.Anto Johny, and V.Kumar, **J.Mat.Sci.: Mat. Elec**,25,1456(2014)
64. Non linear optical absorption in lithium doped ZnO thin films, T. Anto Johny , V.Kumar, P.Sudheesh and K.Chandrasekharan, **Opt.Commun**,309,279(2013)
63. Facile Aqueous Synthesis of ZnO Nanorods and it's Photocatalytic studies, N.Manoj, P.M. Aparna, K.Vijila, K.V.Baiju and V.Kumar, Proceedings of **Indo-US Workshop on Nanomaterials(IUSWNM)**, C-MET, Thrissur, India 2013
62. Titania films with Anatase-Rutile interface by simple sol-gel method for enhanced Photocatalytic Application, K.Vijila, K.V.Baiju and V.Kumar, Proceedings of **Indo-US Workshop on Nanomaterials(IUSWNM)**, C-MET, Thrissur, India 2013
61. Influence of defect mobility on electrostrain in (Ba<sub>0.80</sub>Sr<sub>0.20</sub>)TiO<sub>3</sub>, K.Vani and V.Kumar, **AIP Advances**,2,042177(2012)
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57. PZT Thin Film: Influence of Film Texture For Microactuator Applications.,D Ambika, V Kumar, K Tomioka and Isaku Kanno, **Proceedings of 1st International Symposium on Physics and Technology of Sensors (ISPTS)**,C-MET,Pune, Mar.2012
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54. Chemical solution deposition and nonlinear dielectric characteristics of (Pb<sub>0.5</sub>Sr<sub>0.5</sub>)TiO<sub>3</sub> thin films, D.Ambika and V.Kumar, **J.Phys.D: Appl.Phys**,43, 065401(2010)
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51. FERROELECTRIC GLASS-CERAMICS: V.Kumar, Proceedings of **International Workshop and Symposium on Synthesis and Characterization of Glass /Glass Ceramics (IWSSCGGC-2010)** ,C-MET,Pune, 7-10 July, 2010
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49. Non-linear optical properties of (Pb<sub>1-x</sub>Sr<sub>x</sub>)TiO<sub>3</sub> thin films, D. Ambika, V.Kumar, C.S. Suchand Sandeep and Reji Philip, **Appl. Phys. B**, 97,661-664(2009)

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47. Synthesis and piezoelectric properties of PZT-based glass ceramics, K.P. Rema and V.Kumar, **J.Mat.Sci.: Mat. Elec.**,20,380-385(2009)
46. Influence of low lanthanum doping on the electrical characteristics of PZT(53/47), K.P. Rema, A.S. Divya and V.Kumar, **J.Phys.D: Appl.Phys**,42,075420-'25(2009)
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29. Preparation and characterization of ZnO thin films," T. Anto Johny, V.P.N. Nampoori V. Kumar , **National Seminar on Modern Trends in Materials Science**, Calicut University, 29-30 August, 2005

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25. Third order nonlinear optical properties of ZnO thin films using z- scan technique," A Deepthy, D Ambika, Sajan D George, V Kumar and V P N Nampoori (Paper presented in **Photonics 2004, Seventh International Conference on Optoelectronics, Fiber Optics and Photonics**, 9th to 11th December 2004, Cochin, Kerala, India.
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16. Characterisation of Barium titanate nano-size powders," V. Kumar and I. Packia selvam, Paper presented in **National Seminar on Current Trends in Materials Science** held at Mahatma Gandhi University, Kottayam during March 23-24, 2001
15. Nanosized zirconate and titanate powder for enhanced device performance" V.Kumar, K.R. Dayas and N. Raghu , Paper presented in **National workshop on Piezoceramics and Devices** held at Armament Research and Development Establishment, [DRDO] Pune on 15.2. 2000
14. Solution-Precipitation of fine powders of BaTiO<sub>3</sub> and SrTiO<sub>3</sub>, V.Kumar, **J. Am. Ceram Soc**,82(10),2580-2584(1999)
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10. Sol-Gel processing of  $\text{PbTiO}_3$  thin-films," V.Kumar, Y.Ohya and Y.Takahashi (paper presented in **NSFD-X** held at IIT Madras during Dec. 16-18,1998)
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4. Interaction of heterocyclic thioamides with Tellurium(II) and Tellurium(IV). Synthesis and Crystal Structures of Bis [2-(2- thioxo 1,3-thiazolidin-3-yl)-4,5-dihydro-1,3thiazolium]] hexabromotellurate(IV) and Tris(1-methyl imidazoline- 2(3H)-thione) tellurium(II)bromide, V.Kumar, G Aravamudan and M Seshasayee, *Polyhedron*,9(24),2879-2885(1990)
3. Structure of chloro(Nitrioltriethanolato)Cobalt(II), Radha Akella, M.Seshasayee, V.Kumar and G.Aravamudan, *Acta Cryst*,C45(6),882-4(1989)
2. 2-[2-Thioxo-1, 3-thiazolidin-3-yl]-4, 5-dihydro-1, 3-thiazolium bromide.  $^1\text{H-NMR}$ , Mass Spectral, XPES studies and crystal structure determination, V.Kumar, G.Aravamudan, V.Ganesh, M.Seshasayee, D.Heijdenrijk and H.Schenk *Phosphorus, Sulfur and Silicon*,45(1),15-22(1989)
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### List of Patents

1. PIEZOELECTRIC COMPOSITION, METHODS AND APPLICATIONS THEREOF  
A.Anil, V.Priyadarsini, M.Sathyanarayanan and V.Kumar
  - **US Patent** No.10720565; 21.07.2020
  - **Indian Patent** -1372/DEL/2015 filed on May 15, 2015
2. NANO-ZINC OXIDE, PROCESS OF PREPARATION AND APPLICATIONS THEREOF  
N.Manoj, K.V. Baiju and V.Kumar
  - **Indian Patent** - 2348/DEL/2015 - Granted 25.11.2019
3. A PROCESS FOR PREPARATION OF  $\text{BaTiO}_3$ , V.Kumar
  - **Indian Patent** – 197127- Granted 31.7.2009

#### 4. A PROCESS FOR PREPARATION OF STRONTIUM TITANATE POWDERS

V.Kumar, K.J.Stanly, K.Jayan, K.Sivanandan, P.K.Girija.

- **Indian Patent-** 215393 –Granted 14.3.2008

#### **Research Guidance**

Guided students pursuing their Post graduate (M.Sc./M.Tech.) projects and Ph.D

- Ph.D students guided - 11
- under guidance – 1
- M.Sc./M.Tech projects – 40

#### **Books published**

Contributing Author in Chapter entitled “ FERROELECTRIC GLASS-CERAMICS” in the book ADVANCED SENSOR AND DETECTION MATERIALS published by JOHN WILEY& SONS, May 2014

#### **Invited lectures**

1.PIEZOELECTRIC MICROMACHINED DEVICES FOR SENSING AND IMAGING- Invited lecture delivered at **FDP on Biomedical devices** organised by C-DAC,Thiruvananthapuram on 26.11.2021

2.FERROELECTRICS OR RELAXOR: A TUG OF WAR – Invited lecture delivered at the **Second Symposium on Advances in Ferro & Piezoelectrics(SAFE-21)**-Materials-Process-Devices jointly organized by RIC(DRDO) & IIT, Madras, on 17.9.2021

3.CHEMISTRY OF MATERIALS- Inaugural address delivered at the **Refresher course on Chemical Sciences** conducted jointly by UGC and Kannur University on 14.8.2020.

4.PIEZOELECTRIC VIBRATION ENERGY HARVESTERS – Invited lecture delivered at the **Workshop on Condensed Matter and Materials Science** organized by KSCSTE-SRIBS [Kerala state Council for Science,Technology and Engineering-Srinivasa Ramanujan Institute for Basic Sciences] and C-MET at C-MET,Thrissur on 21.9.2019.

5.NANOMATERIALS FOR DEVICE APPLICATIONS – Invited lecture delivered at the **Faculty Development Programme sponsored by APJ Abdul Kalam Technological University** and organized by MGM College of Engineering and Technology,Pampakuda on 13.6.2019

6.LOCAL STRUCTURAL REARRANGEMENTS IN COMPLEX PEROVSKITES – Invited lecture at the **International Conference on Chemistry and Physics of Materials (ICCPM)** organized by St.Thomas College,Trissur on 20.12.2018

7.DESIGN OF TRANSDUCER MATERIALS : A RAMAN PERSPECTIVE , Invited lecture delivered at **National Seminar on Advanced Materials-ADMAT 2018** organised by School of Pure and Applied Physics, Mahatma Gandhi University, Kottayam during 23-24 March,2018.

8.**ns<sup>2</sup> LONE PAIR – AN IMPORTANT HANDLE FOR MATERIALS DESIGN**: Invited lecture delivered at National Seminar on **Frontiers in Chemical Sciences 2018**, organised by Department of Chemistry, Calicut University, Calicut during 26-28 February,2018.

9. NLO PROPERTIES OF FERROELECTRIC THIN FILMS : Invited lecture delivered at **National Seminar on Contemporary Trends in Physics**, School of Physics, Kannur University, Kannur during 20-21 March, 2018.
10. DESIGN OF NEW MATERIALS ; APPROACH THROUGH DEFECT CHEMISTRY: Invited lecture delivered at National Seminar on **Science and technology of New Materials for Sustainable Future**, organised by Department of Physics, Calicut University, Calicut during 7-9 February, 2018.
11. DEFECT CHEMISTRY: A GOLDMINE FOR TAILORING MATERIALS, Plenary lecture at Seminar on **Frontiers in Chemistry** organized by Department of Chemistry, Calicut University, Calicut on 2.3.2017.
12. NANOMATERIALS FOR DEVICE APPLICATIONS , Invited lecture delivered at the **National Workshop on Nanomaterials and Nanocomposites** held at Amrita Viswavidyapeetam, Coimbatore on 4.2.2017.
13. CHEMISTRY OF MATERIALS, Prof.K.P. Antony Memorial Lecture delivered at the **National Seminar on Frontiers in Applied Chemistry**, St.Thomas College, Trissur on 7.2.2017.
14. CHEMISTRY OF MATERIALS : Keynote address delivered at UGC sponsored **National Seminar on Chemistry** organized by Department of Chemistry, St.Joseph's College, Irinjalakudar on 28.1.2016.
15. CHEMISTRY OF MATERIALS : **Prof.V.A.Joseph Endowment lecture** delivered at Dept.of Chemistry, Sacred Heart's College, Thevara, Ernakulam on 9.2.2016.
16. CHEMISTRY OF MATERIALS : Plenary lecture at Seminar on **Advances in Materials Chemistry** organized by Department of Chemistry, Calicut University, Calicut on 5.12.2014
17. PIEZOELECTRIC THIN FILMS FOR MEMS APPLICATIONS : Invited lecture at **Continous Education Program on Recent Trends in Underwater Transducers** conducted by NPOL, Cochin on 14.10.2014.
18. NANOFERROELECTRIC-GLASS FOR ELECTRONICS APPLICATIONS, Invited lecture at **Second refresher course in Nanoscience** organized by UGC-Academic Staff College, Calicut University, Calicut on 17.9.2014
19. PZT THIN FILMS. INFLUENCE OF FILM TEXTURE FOR MICROACTUATOR APPLICATIONS" Invited lecture delivered at the **IUMRS-ICA 2013 International Symposium** held at IISc, Bangalore. during Dec.16-20, 2013.
20. FERROELECTRIC GLASS CERAMICS : Invited lecture at **UGC-sponsored National Seminar on Advanced Materials** organized by Department of Physics, Mahatma Gandhi University , Kottayam on Jan.19.2012.
21. NANOMATERIALS: CHARACTERISATION Invited lecture at **Continuing Education Program on Science and Technology of Nanomaterials**, held at NPOL, DRDO, Cochin on 21.9.2011.
22. FERROELECTRIC GLASS-CERAMICS: SYNTHESIS, CHARACTERISATION AND DEVICE APPLICATIONS Invited lecture at **National Science Day** organized by Department of Physics, Cochin University of Science and Technology, Cochin on March 1, 2010.
23. NANOMATERIALS: IMPACT ON NANOTECHNOLOGY, Invited lecture at **Short Term Training programme on NanoScience and Nanotechnology** organized by Department of Chemical Engineering, Govt. Engineering College, Trissur on Jan.21, 2010.
24. NANOFERROELECTRICS Invited lecture at Workshop sponsored by UGC organized by Department of NANOMATERIALS SCIENCE AND TECHNOLOGY, Calicut University, Calicut on Aug. 26, 2009.



25.FERROELECTRIC GLASS-CERAMICS: SYNTHESIS,CHARACTERISATION AND APPLICATIONS  
Invited lecture at **National Seminar on Advances in Physical and Theoretical Chemistry** organized by Department of Chemistry, Calicut University, Calicut on March 28, 2009.

26.PIEZOELECTRIC THIN FILMS FOR MEMS Invited lecture at **Workshop on Advanced Materials** sponsored by UGC organized by Department of Physics, Calicut University, Calicut on March 26, 2009.

27.NANOMATERIALS FOR ELECTRONICS APPLICATIONS Invited lecture at **National Seminar on Nanotechnology** organized by School of Chemical Sciences, Kannur University, Kannur on December 14, 2007.

28.RECENT TRENDS IN MEMS AND NANOTECHNOLOGY Invited lecture at Continuing Education Program held at NPOL, DRDO, Cochin on 5.11.2008.

29.MATERIALS FOR ACTUATOR APPLICATIONS Invited lecture at **Workshop on Advanced Materials** sponsored by UGC organized by Department of Physics, Calicut University, Calicut on December 6, 2007.

30.NANOMATERIALS FOR ELECTRONICS APPLICATIONS : Invited lecture at **National Seminar on Nanotechnology : The Technology of the Future** organized by Dept. of Mechanical Engineering, Govt. Engineering College, Trivandrum on March 28, 2007 at Kanakakkunnu Palace, Trivandrum.

31.NANOCRYSTALLINE MATERIALS : Synthesis and Applications, Invited lecture delivered at **National Seminar on Emerging Trends and New Vistas in Chemistry,( EMTIC)**,Calicut University, Nov.29-30, 2005.

### ***R&D Projects implemented as PI***

Developed strong linkages with industry/end-user, for undertaking and implementing projects of direct relevance to them. This includes an establishment of a semi-pilot production facility, product/process costing, technology costing, protection of IPR and technology transfer initiatives.

- 9 R&D Projects funded by DST (4), DRDO (3), ISRO (1), MeitY (1) with a total funding of nearly 900 lakhs successfully completed.
- 2 projects funded by SERB and MeitY are under implementation and in the final stage.

### ***Academic courses handled***

- MATERIALS CHEMISTRY – University of Calicut, MG University
- CERAMIC MATERIALS & NANOTECHNOLOGY – Kannur University

### ***Professional assignments***

- Visitng Scientist, Kobe University, Japan - April 2022
- Visitng Scientist, Kobe University, Japan - February 2019
- Visitng Scientist, Gifu University, Japan - Jan.1996 – Mar.1997

### ***Professional experience – Administrative***

#### **Director**

Centre for Materials for Electronics Technology[C-MET], Trissur

June 2014 – Aug 2016

## **Major Administrative achievements**

- Demonstrated leadership in setting up world-class infrastructure, and in formulating technology-related projects in frontier areas of materials science.
- Enabled fellow Scientists to receive significant financial support (about Rs.25.00 Crores), in a very short span of two years, for initiating many important projects of strategic and societal significance.
- Promoted development of specific products with special focus on technology transfer.
- Transferred 3 technologies developed at C-MET, Thrissur to Indian industries.
- Initiated technology transfer to a MNC.
- Led several industry and academic collaborations with MNC's and foreign universities.

## **Other Professional assignments**

- Member, FMC, SAIF, IIT, Madras- 2018 onwards
- Member, Board of studies in Materials Science- Mangalore University- 2018 onwards
- Member, Board of Studies in Nanoscience and Nanotechnology, Calicut University, Calicut 2010-2012; 2012-2014; and 2020 onwards
- Member, Board of studies in Materials Science, Kannur University, Kannur,2009-2015
- Member, Research Advisory Board, Sri Sathyasai Institute of Higher Learning, Puttaparthi-2014-17

## **Awards:**

- Recipient of MRSI (Materials Research Society of India) Award for 2015 for outstanding contributions in Materials Science and Engineering.

## **References**

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