

## Dr. Sajith Kurian

Assistant Professor  
Department of Chemistry  
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### Professional Goal

To be an academician through research and teaching.

### Research

Energy storage and conversion materials like Li-ion batteries, solar cells and fuel cells

### Interests

Synthesis of nanomaterials, their self-assembly, chemical modification and their applications. item

Nanostructured systems (nanoparticles, nanocomposites) which show unusual behaviour due to their low dimension and probable disorder at surface as well as at interior of the particles

Development of high efficiency solar cells using inorganic nanotubes and nanorods especially using perovskite materials

Atomic Layer Deposition (ALD), Chemical Vapour Deposition (CVD), Sputtering, Chemical Bath Deposition (CBD), Anodization and Spin coating

Synthesis of semiconductor/metallic one dimensional nanostructures (nanowires, nanotubes, nanorods) and nanoparticles for several applications

Carbon nanotubes, graphene - growth and application

Synthesis, characterization and properties of thermoelectric and Multiferroic materials Magnetism and Magnetic Materials

Teaching	Courses on nanomaterials, various synthesis techniques - physical and chemical
Interests	<p>Characterization techniques and the applications of nanomaterials in various fields of technology-including the latest trends and advances, electron microscopy, characterization of materials and structural, magnetic and electronic properties of materials.</p> <p>Courses on solid state chemistry, modern physical methods in chemistry, Principles of physical chemistry, thermodynamics, electrochemistry and spectroscopy.</p> <p>Laboratory courses for physical/Inorganic/Organic Chemistry.</p>
Education	<p>Hanyang University, Seoul, Korea</p> <p>Post-Doctor, March, 2013 - August 2013 with Prof. Wonbong Choi</p> <p>Post-Doctor, November, 2011- February 2013 with Prof.Hyeongtag Jeon</p> <p>Indian Institute of Technology Kanpur, Kanpur, Uttar Pradesh, India</p> <p>Doctorate in Chemistry, July 2011</p> <p>Thesis Topic: \Synthesis, Structural, Magnetic and Mossbauer Spectroscopic Studies of <math>\text{Fe}_x\text{N}</math> (<math>x = 2.31</math> and <math>2.94</math>), <math>^0\text{Fe}_4\text{N}</math> Nanoparticles and <math>^0\text{Fe}_4\text{N}</math> GaN Nanocomposites."</p> <p>Advisors: Namdeo S Gajbhiye and P. K. Bharadwaj</p> <p>Mahatma Gandhi University, Kerala, India</p> <p>M.Sc., Chemistry, July, 2002 (First Class,70.8%)</p> <p>Calicut University, Kerala, India</p> <p>B.Sc., Chemistry, May, 2000 (First Class,81.2%)</p>
Research Experience	<p>Current research activity is on the perovskite based solar cells; broadly, Synthesis of new perovskite materials, its characterization and testing the efficiency in solar energy conversion. Stable and environment friendly perovskite material is the focus of our research and the light absorbing perovskite material will be used for photocatalytic water splitting.</p> <p>I was engaged in the synthesis of carbon nanotube and graphene using thermal and ICP CVD for Li-ion battery applications. Three dimensional metallic and nonmetallic nanoframes were made by sputtering and ALD. In addition to this I was working on the synthesis and characterization of one dimensional nanostructures of semiconductors like <math>\text{TiO}_2</math> and <math>\text{ZnO}</math> using anodization, hydrothermal and spin coating methods. The surface of these synthesized materials were modified using thermal and remote plasma Atomic Layer Deposition (ALD) method to enhance the efficiency in photovoltaic and photocatalytic applications. Integration of metallic nanoparticles for enhancing the efficiency of DSSC and Inorganic-Organic hybrid solar cells using the surface plasmon phenomena was also considered.</p> <p>During my doctoral work, I worked on the synthesis of magnetic nanoparticles and nanocomposites which show unusual behaviour due to their low dimension and probable disorder at surface as well</p>

as at  
interior of

the particles. I studied the magnetic and Mossbauer characteristics of iron nitrides at room temperature and low temperature.

Projects

Fast Track Project under Young Scientist Scheme on 'Perovskite Solar Cells for Efficient Photocat-

Sanctioned

alytic Water Splitting', approved by SERB-DST. Project Term - 3 Years (ongoing).

## Teaching Experience

Mar Ivanios College (Autonomous), Nalanchira, Thiruvananthapuram, Kerala, India Assistant Professor September 23, 2015 - till date Teaching PG and UG Students.

M.Sc. and B.Sc.

Amal Jyothi College of Engineering, Kanjirappally, Kerala, India

Associate Professor

July 15, 2014 - September 2015

Teaching Engineering Chemistry for the Bachelor of Technology Students  
Teaching Nanotechnology for M.Tech Nanotechnology Students

B.Tech and M.Tech

Kannur University, Payyannur Campus, Payyannur, Kerala, India

Guest Lecturer August 25 - October 25, 2011 Taught Chemical Thermodynamics and Polymer Chemistry courses and conducted Organic Chemistry Lab course for the Master of Science in Chemistry.

M.Sc Chemistry

Indian Institute of Technology Kanpur, Kanpur, India

Teaching Assistant

July - May, 2006 - 2007, January - May, 2008

Co-taught graduate level Lab course for the Master of Science in Chemistry. Shared responsibility for lectures, exams, weekly chemistry lab exercises, and grades.

CHM 423 Physical Chemistry Lab Course

Teaching Assistant

January - May, 2008

Co-taught under graduate level Lab course for the Bachelor of Technology students. Shared responsibility for lectures, exams, weekly chemistry lab exercises, and grades.

CHM 101 Introductory Chemistry Lab Course

## Publications

### Journals

1. Sajith Kurian, Hyungtak Seo and Hyeongtag Jeon \Significant Enhancement in Visible light absorption of TiO<sub>2</sub> Nanotube arrays by surface bandgap tuning", J.Phys.Chem.C, 117, 16811, (2013)
2. Sajith Kurian, P. Sudhagar, Jaesang Lee, Donghoon Song, Woohyung Choi, Sanghun Lee, Young Soo Kang and Hyeongtag Jeon, \Formation of crystalline nanotube/nanoparticle hybrid by post water treatment of thin amorphous TiO<sub>2</sub> layer decorated on TiO<sub>2</sub> nanotube array for efficient photoanode in dye-sensitized solar cells, J.Mater.Chem. A 1, 4370, (2013)
3. S. K. S Patel, Sajith Kurian and N. S. Gajbhiye, \Room temperature ferromagnetism of Fe-doped TiO<sub>2</sub> nanoparticles driven by oxygen vacancy ", Material Research Bulletin 48, 655, (2013)

4. S. K. S Patel, Sajith Kurian and N. S. Gajbhiye, \Phase dependent room temperature ferromagnetism of Fe-dopedTiO<sub>2</sub> nanorods ", AIP Advances 2, 012107, (2012)
5. Arles V. Gil Rebaza, Judith Desimoni, Sajith Kurian, Sayan Bhattacharyya, N. S. Gajbhiye and Eitel L. Peltzer y Blanc \Ab Initio Study of the Structural, Electronic, Magnetic, and Hyper ne Properties of Ga<sub>x</sub>Fe<sub>4x</sub>N (0.00 x 1.00) " , J. Phys. Chem. C 115, 23081, (2011)
6. Sajith Kurian and N. S. Gajbhiye, \Synthesis, Magnetic and Mossbauer study of (2 < Fe<sub>x</sub>N x < 3) nanowires", Mater. Lett. 65, 3089, (2011)

7. Seema Verma, P. A. Joy and Sajith Kurian, "Structural, Magnetic and Mossbauer spectral studies of nanocrystalline Ni<sub>0.5</sub>Zn<sub>0.5</sub>Fe<sub>2</sub>O<sub>4</sub> ferrite", J. Alloy Compds. 509, 8999, (2011)
8. Sajith Kurian, Sayan Bhattacharyya, Judith Desimoni, Eitel L. Peltzer y Blanca, Arles V. Gil Rebaza, and N. S. Gajbhiye, "Investigation of <sup>0</sup> Fe<sub>4</sub>N GaN Nanocomposites: Structural and Magnetic Characterization, Mossbauer Spectroscopy and ab-initio calculations ", J. Phys. Chem. C 114, 17542, (2010)
9. Sajith Kurian and N.S.Gajbhiye, "Low temperature and in- eld Mossbauer spectroscopic studies of Fe<sub>3</sub>N particles synthesized from iron citrate complex ", Chem. Phys. Lett. 493, 299, (2010).
10. Sajith Kurian and N.S.Gajbhiye, "Magnetic and Mossbauer study of Fe<sub>y</sub>N (2<y<3) nanoparticles", J. Nanopart. Res. 12, 1197, (2010).
11. Sajith Kurian and N.S.Gajbhiye, "Non-Collinear spin structure of Fe<sub>x</sub>N (2<x<3) observed by Mossbauer spectroscopy", Chem. Phys. Lett. 489, 195, (2010).
12. Sayan Bhattacharyya, Sajith Kurian, S.M.Shivaprasad and N.S.Gajbhiye, "Synthesis and Magnetic Characterization of CoMoN<sub>2</sub> Nanoparticles" J. Nanopart. Res. 12, 1107 (2010).
13. Sajith Kurian and N.S.Gajbhiye "Mossbauer and magnetic studies of nanocrystalline Fe<sub>4</sub>N", Hyper ne Interact. 183, 147, (2008).
14. Ahmed. A, Gajbhiye N. S and Kurian. S "Structural and magnetic properties of self assembled Fe-doped Cu<sub>2</sub>O nanorods", J. Solid State Chem. 183, 2248, (2010).
15. Sarita Rai, Sajith Kurian, V.N.Dwivedi, S.S.Das, N.B.Singh and N.S.Gajbhiye, "Mossbauer and calorimetric studies of portland cement hydration in the presence of black gram pulse" Hyper ne Interact. 188, 19, (2009).
16. K.C.Dewangan, R.S.Ningthoujam, Sajith Kurian and N.S.Gajbhiye, "Magnetic and Mossbauer properties of Fe doped VN nanoparticles" Hyper ne Interact. 183, 185, (2008).
17. P.Smitha, P.K.Pandey, Sajith Kurian and N.S.Gajbhiye, "Mossbauer studies and magnetic properties of spinel lead ferrite." Hyper ne Interact 184, 129, (2008)
18. Mrudul Gadhvi, S.Srivastava, Sajith Kurian, N.S.Gajbhiye, "Mossbauer Spectroscopy and magnetic studies of orientated textured Fe<sub>3</sub>O<sub>4</sub> ferro uid", Hyper ne Interact. 188, 59, (2009)
19. Tapas Ranjan Sahoo, S. Sundar Manoharan, Sajith Kurian and N.S.Gajbhiye, "Mossbauer spectroscopic study of iron-doped zirconia synthesized by microwave route" Hyper ne Interact. 188, 43, (2009)
20. R.Shukla, R.S.Ningthoujam, S.S.Umare, S.J.Sharma, Sajith Kurian, R.K.Vatsa, A.K.Tyagi and N.S.Gajbhiye, "Decrease of superparamagnetic fraction at room temperature in ultra ne CoFe<sub>2</sub>O<sub>4</sub> particles by Ag doping" Hyper ne Interact. 184, 217, (2008).
21. R.S.Ningthoujam, S.S.Umare, S.J.Sharma, R.Shukla, Sajith Kurian, R.K.Vatsa, A.K.Tyagi,

R.Tewari, G.K.Dey and N.S.Gajbhiye, "Magnetic and Mossbauer studies on nanocrystalline  $\text{Co}_{1-x}\text{Li}_x\text{Fe}_2\text{O}_4$  ( $x = 0, 0.2$ )" *Hyperfine Interact.* 184, 227, (2008).

22. S.S.Umare, R.S.Ningthoujam, S.J.Sharma, S.Shrivastava, Sajith Kurian and N.S.Gajbhiye,

"Mossbauer and Magnetic studies on nanocrystalline  $\text{NiFe}_2\text{O}_4$  Particles prepared by ethylene glycol route" *Hyperfine Interact.* 184, 649, (2008).

23. Sajith Kurian, P. Sudhagar, Heeyoung Jeon and Heongtag jeon, "Atomic Layer Deposition of Amorphous  $\text{TiO}_2$  as Passivation Layer on  $\text{TiO}_2$  Nanotube Array Photoanode and Their Photovoltaic Performance in Dye-Sensitized Solar Cells, Manuscript to be submitted.

24. Sajith Kurian and Heongtag jeon, "  $\text{TiO}_2$ -  $\text{ZnO}$  - $\text{Al}_2\text{O}_3$  heterostructure and its application in Dye-Sensitized Solar Cells, Manuscript to be submitted.

## Conference Publications

1. Sajith Kurian, N.S.Gajbhiye and S.K.Date, "Investigation of different iron sites in Fe<sub>3</sub>O<sub>4</sub> (2<y<3) nanoparticles using Mossbauer spectroscopy", J. Phys.: Conf. Ser. 217, 012107, (2010).
2. N.S.Gajbhiye, S.Srivastava, Sajith Kurian, B.R.Behta and V.N.Singh, "Magnetic Field Assisted hydrothermal synthesis of CoFe<sub>2</sub>O<sub>4</sub> Nanowires", J. Phys.: Conf. Ser. 200, 072093, (2010).

## Books

1. Dr. Soney C George, Dr. Sajith Kurian, Rino Laly Jose, Engineering Chemistry, S. Chand & Company Pvt Ltd 2016

Conferences/  
workshops  
attended

Two day Workshop & Training Session on 'Wet Chemical Routes to High Efficiency Third-Generation Solar Cells' at CSIR-NIIST Trivandrum (April 23-24, 2018)

National Seminar on 'NMR Spectroscopy and its Biomedical Applications' at Mar Ivanios College (Autonomous), Thiruvananthapuram (October 6-7, 2016)

Workshop on 'Inorganic Practicals' by Academy of Chemistry Teachers, Kerala, at SN College Kollam (August 27, 2016)

National Seminar on 'Nanomaterials and its Applications', at Mar Ivanios College (Autonomous), Thiruvananthapuram (October 1, 2015)

Faculty Development Programme on 'Recent Advances on Nanoscience and Nanotechnology' sponsored by DST at Amal Jyothi College of Engineering, Kanjirappally (April 20 - May 1, 2015)

Third International Symposium on Materials Chemistry at Bhabha Atomic Research Centre, Mumbai, India (December 7-December 11, 2010)

17<sup>th</sup> International Symposium on Metastable, Amorphous and Nanostructured Materials at Swiss Federal Institute of Technology Zurich, Switzerland (July 4-July 9, 2010)

International Conference on the Applications of the Mossbauer Effect (ICAME) at Vienna Institute of Technology Vienna, Austria (July 19-July 25, 2009)

International Conference on the Applications of the Mossbauer Effect (ICAME) at Indian Institute of Technology Kanpur, India (October 14-October 19, 2007)

Professional skills  
and Experience

Experience in Thin Film deposition technique using Atomic Layer Deposition (ALD), CVD, Sputtering, e-beam evaporation, Spin Coating  
Experience in Graphene growth using CVD system. Experience in Li-ion button cell fabrication

Solar cell (DSSC) fabrication and testing

Experience in synthesizing one dimensional structures by anodization and hydrothermal methods  
Experience in growing carbon nanotube using thermal CVD and its characterization



Experience in synthesizing and characterizing Iron nitride nanoparticles

Extensive experience in working with Low temperature and Room temperature Mossbauer spectrometer and spectral analysis

Hands-on experience of Four-probe resistivity setup

Experience with major characterization techniques like XRD, Rietveld analysis, SEM, TEM, VSM, Raman and SQUID  
Acquaintance with temperatures in the range 4-300  
K Experience in working with clean room facilities

Experience in working with Glove box

#### Honours and Awards

Operation and maintenance of vacuum of the order of  $10^{-7}$  mbar using a turbomolecular pump  
Familiarity with Origin, L<sup>A</sup>T<sub>E</sub>X and other general software's

BK 21 Post-Doctoral fellowship, A Korean Government 'Brain Korea 21<sup>st</sup> century' research fellowship.

Qualified Graduate Aptitude Test in Engineering (GATE) in 2004

Qualified National Eligibility Test conducted by University Grants Commission, India

Selected for the FLAIR Programme by the Directorate of Collegiate Education, Kerala Government