Winter 11-1-2022

Integration of Photonics technologies with Applied Nanosciences for sensing and particle manipulation

Sajan Daniel George Prof.

Dr. Sajan Daniel George FRSC FICS

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Coordinator – Centre for Applied Nanosciences (CANs)
University (Dr. T M A Pai) Endowment Chair in Applied Nanosciences
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EDUCATION

Ph.D. in Photonics, Cochin University of Science and Technology, India - 2004
Department: International School of Photonics
Advisors: Dr. C. P. Girijavallabhan and Dr. V. P. N. Nampoori
Dissertation: Laser-induced photothermal investigations on thermal and transport properties of certain selected photonic materials.

EMPLOYMENT

Manipal Academy of Higher Education 2022 – till date
Professor and Head – Department of Atomic and Molecular Physics
Department of Atomic and Molecular Physics

Manipal Academy of Higher Education 2018 – till date
Professor – Department of Atomic and Molecular Physics
Department of Atomic and Molecular Physics

Manipal Academy of Higher Education 2017 – 2019
Dr. TMA Pai Endowment Chair in Applied Nanosciences
Department of Atomic and Molecular Physics

Manipal Academy of Higher Education 2016 – till date
Coordinator – Centre for Applied Nanosciences
Department of Atomic and Molecular Physics

Manipal Academy of Higher Education 2012 – 2017
Associate Professor
Department of Atomic and Molecular Physics

TU Darmstadt, Germany 2009 – 2012
Wissenschalicher Mitarbeiter
Center of Smart Interfaces, DFG cluster of excellence
Prof: Steffen Hardt

Leibniz University of Hannover, Germany 2007 – 2009
Wissenschalicher Mitarbeiter
Institute of Nano and Microprocess Technology
Prof: Steffen Hardt

Manipal University 2006 – 2007
Assistant Professor

Department: Center for Laser Spectroscopy
Katholieke University of Leuven, Belgium 2004 – 2005
KU Leuven Postdoctoral Fellow
Department: Acoustic and Thermal Physics Laboratory
Prof: Christ Glorieux

AWARDS AND HONORS

2022 – Fellow, Royal Society of Chemistry, London, UK
2021 – Fellow, Indian Chemical Society
2017 – Dr. T M A Pai Endowment Chair in Applied Nanosciences
2017 – Top 20 Candidates of the MAHE-SMILE leadership program
2009 – AufthenG 19 – (Permanent Residenceship for highly qualified scientists in Germany)
2006 - FCT Fellowship, Ministry of Portugal, Portugal (not joined)
2004 - KU Leuven Postdoctoral Fellow, Belgium
2004 - Best Researcher, International School of Photonics, Cochin University of Science and Technology
2002 - Senior Research Fellow, Council of Scientific and Industrial Research
2000 - Junior Research Fellow, Council of Scientific and Industrial Research
2000 - Graduate Aptitude Test in Engineering qualified
1999 – Joint Entrance Screening Test to join for Ph.D. in premier institutes in the country
1999 - Council of Scientific and Industrial Research – Junior Research Fellowship and University Grants Commission - National Eligibility Test qualified
1996 - Fr. Stanely Roman Retirement Memorial Award

Research Interests: Nanoscale Surface Engineering for Photonics Applications, Bio-Photonics, Optical Manipulation of Particles, Photothermal Techniques

EXTERNAL POSITIONS AND SERVICES

Editor, Frontiers in Chemical Engineering (2022-
Editor - Frontiers in Physics (2022 -
Editor - Frontiers in Analytical Chemistry (2022-
Editor of Scientific Reports, Nature Publications, USA (2013-
Editor, International Journal of Wettability Science and Technology, Old Publishing Group, USA (2019 –
Editor of Photonics, MDPI, Switzerland (2020-
Review Editor – Frontiers in Analytical Chemistry (2022-
Review Editor – Frontiers in Physics (2022-
Review Editor – Frontiers in Chemical Engineering (2022-
Guest Editor – Frontiers in Physics (2022-

Project Review Committee Member of US Department of Defense
Project Review Committee Member of Government of Romania
Project Reviewer of Department of Science and Technology, India
Project Reviewer of the Science and Engineering Research Board, India
Project Reviewer of Kerala State Council for Science, Technology & Environment.

Project Reviewer of Institute of Eminence, Central University of Hydrebad, India

Reviewer of (more than 35 publications) of different publishers (SPIE, OSA, AIP, Elsevier, Nature, RSC, ACS, Springer, Taylor and Francis, IOP, American Scientific Publishers)

Ph.D. Thesis Evaluator
– Mc Gill University, Canada
– University of Mumbai, Mumbai, India
– Mangalore University, Karnataka, India
– Cochin University of Science and Technology, Kerala, India
– Mahatma Gandhi University, Kerala, India

Membership –

Invited Member – American Nanosocieity
Member – SPIE, USA
Member – Indian Laser Association
Member – Laser Spectroscopy Society of India
Member – Society for Materials Chemistry
Member – Photonics Society of India

Committee Member of International Symposia/Conference

1) International eWorkshop on Science and Technology of Emerging Materials (eSTEM-21), 19-21 April 2021, Chettinad College of Engineering, India
2) 2nd International Conference of Nature Inspired Surface Engineering (NISE-2022), 10-12 August 2022, Seoul National University, Seoul, South Korea
3) 1st International Conference on Nature Inspired Surface Engineering (NISE-2019), 11-14 June 2019, Stevens Institute of Technology, New Jersey, USA
4) 10th International Symposium on Photonics and Optoelectronics (SOPO-2017), August 18-20, Guilin, China
5) International Advisory Committee member of EMN meeting on Quantum Matter Energy Materials Nanotechnology, Mauritius, November 30-December 4, 2016
6) International Conference on Mechanism, Electronics, and Automation (MEA -2016), November 25-27, Shenzhen, China
7) The International Conference on Material Engineering and Application (ICMEA 2016), November 12-13, Shanghai, China
8) 9th International Symposium on Photonics and Optoelectronics (SOPO -2016), August 26-28, Xian, China
9) Organizing Committee member of Asia-Pacific Engineering Conference (APETC-2016), June 25-26, Bangkok, Thailand
10) 8th International Symposium on Photonics and Optoelectronics (SOPO -2015), August 22-24, Shanghai, China
11) 2nd Laser and Optoelectronics Conference (LOC 2015), October 23-25, Suzhou, China

RESEARCH GRANTS*

1) **Nanoparticle assisted wettability tailored hemostatic cotton gauze**, Role: PI, Funding: MAHE (2022)

2) **Femtosecond laser-assisted fabrication of wettable and anti-microbial contact lenses** , Role: PI Funding: SERB, DST (2021-2024)

3) **Nanostructured Contact Lenses for Improved Wettability and Antimicrobial Activity**, Funding: Manipal Academy of Higher Education, Role: PI, (2020-2023)

4) **Liquid Biopsy for Oral Cancer Screening using superhydrophobic Surface Enhanced Plasmonic Droplet Assay**, Role: PI, Funding: BDTD (2019-2022)

5) **Nanostructures assisted Laser-induced crystallization**, Role: Co-PI, Funding: Manipal Academy of Higher Education (2019-2022)

6) **Dr. T M A Pai Endowment Chair in Applied Nanosciences**, Funding: Manipal Academy of Higher Education (2017-2019)

7) **Design, Development and Applications of microchannel assisted Thermal Lens Microscope for chemotaxis and heavy metal detection**, Role: PI, Funding: BRNS (2017-2020)

8) **Cellular temperature probing of an optically trapped biological cell using an optical thermometer** , Role -PI, Funding: SERB, DST (2017-2020)

9) **Design, Assembly, Testing and Multi-Centre Evaluation of a Miniature and Portable LIF System for Screening of Oral Malignancy** , Role: Co-PI, Funding: DST (2015-2018)

10) **Microwave-assisted synthesis of spinel oxide phosphors for display applications and white light generation,** Role:Co-PI, Funding: SERB, DST (2015-2018)

11) **Fund for improvement of S&T infrastructure in universities and higher education institutions (FIST)** – Nanobiophotonics, Role: Group Leader, Funding: DST-FIST (2013-2018)

12) **Trace Element Analysis for Environmental and Biomedical Applications - Development of Laser Induced Breakdown Spectroscopy (LIBS) technique**, Role: PI (later changed to Dr. Santhosh C due to non-availability in the country) (2006-2009)

13) **Development of a device for early detection of oral cancer using fluorescence,** Role: Co-I, Funding: Philips Research Systems (2006-2007)

14) **Detection of tumor marker in saliva using HPLC-LIF technique**, Role: Co-I, Funding: Philips Research Systems (2006-2007)

OTHER ACADEMIC ACTIVITIES at the University level

Member, NEP Implementation (Research)	2020-
Digital Champion, MAHE-PwC Progaram	2020-
Member, University NAAC committee	2019-
Member, Grant Office Mentor Group, MAHE	2019-
MAHE-SMILE Candidate	2016-
Member, Interdisciplinary Research Committee, MAHE	2016-

OTHER ACADEMIC ACTIVITIES at the Department level

Head, Department of`Atomic and Molecular Physics	2022 -
Coordinator, Centre for Applied Nanosciences	2016 -
Department Coordinator, International Relations	2015 - 2018
Research Coordinator for Ph.D programs, DAMP	2014 – 2016
Group Leader, FIST program, DAMP	2013 – 2018
Board of Studies Member, DAMP	2012 –
Placement Cell Coordinator, DAMP	2012 – 2018
Member, Doctoral Advisory Committee, DAMP and MAHE	2012 -
Course Coordinator M.Sc Nanoscience and Technology	2012 –

ACADEMIC CONFERNCES ORGANIZED

One day symposium on Recent Advances in Nanoscience and Technology, Convener	(2020)
International Conference on Nanoscience and Photonics for Medical Applications, Co-convener	(2019)
A discussion meeting on Molecular Phenomena at the Nano-Bio Interface, Convener	(2017)
Workshop on Nano and Softmatter Sciences, Co-convener	(2016)
International Symposium on Spectroscopy and Applications, Secretary	(2016)
One day Symposium on Recent Advances in Photonics, Secretary	(2015)
One day Symposium on Recent Advances in Photonics, Secretary	(2014)
Theme meeting on Ultrafast Sciences, Organizer	(2014)
National Laser Symposium (NLS-22), Secretary	(2014)
One day Symposium on Nanoscience and Technology, Secretary	(2013)
One day Symposium on Recent advances in Photonics, Organizer	(2013)
One day Symposium on Recent trends in Biophysics, Organizer	(2013)
Workshop on Photonics in Medicine and Biology, Organizer	(2012)

Invited Talks

2022

- Nanoscale surface engineering for photonics applications Webinar on International Conference on Materials - Properties, Measurements and Applications (ICMPMA 2022), May 9-13, 2022

2020

- Nanostructured Materials and its applications Webinar on Quantum Nano Materials, Fatima Mata National College, Kollam, July 08, 2020
- Biophotonics – Novel approaches for the diagnosis, in AICTE sponsored short-term course on Biotherapeutics Manipal College of Pharmaceutical Sciences, March 11, 2020

- Surface Engineering at Nanoscale and its applications, National Conference on Soft Matter and Functional Materials (SMFM2020), National Institute of Technology, Calicut, Keala, India 2-4 March 2020
- Nanoscale surface engineering for physical applications at Manipal University Jaipur, Rajasthan, ADVANCED NANOMATERIALS, NANOTECHNOLOGY & APPLICATIONS (FDP-ANNA-2020), February 10-14, 2020

2019

- Nature Inspired Nanoscale Surface Engineering, Nanojatha, NIIT University, Mangaluru, India, December 5, 2019
- Applied Nanoscience Research Activity at MAHE-University of Sydney Workshop at MAHE, Manipal India, November 21, 2019
- Femtosecond Laser Tailoring of Surface Wettability for Droplet Control, 1st International Conference on Nature Inspired Surface Engineering at Stevens Institute of Technology, New Jersey, USA, June 11-14, 2019
- Surface Engineering at Nanoscale for Photonics and Microfluidics Applications at MAHE-UNSW, Australia workshop, at Manipal April 4, 2019
- Microfluidics Manipal Institute of Technology-Deakin University collaborative workshop at Manipal, March 18, 2019
- Surface Engineering for Diverse Applications at National Seminar on Nanoscience and Nanotechnology at Bishop Moore College, Mavelikara, Kerala, India, February 18, 2019

2018

- Laser Nanostructuring of Nanomaterials for Diverse Applications in Emerging Frontiers in Chemical Sciences, at Farook College, Calicut, Kerala, 23-24 November, 2018
- Nanostructured Surfaces for Droplet Control in a Refresher Course sponsored by AICTE at MCOPS, Manipal on 16th November 2018

2016

- Fabrication of water and air bubble repelling surfaces via femtosecond laser patterning in Recent Advances in Optical Sciences, University of Hyderabad, May 6-7, 2016
- Tailoring interface properties via femtosecond laser surface patterning at Manipal Research Colloquium, Manipal, April, 4-6, 2016

PATENTS APPLIED

1) "**SELF-MOISTURIZING CONTACT LENS AND A METHOD OF MANUFACTURING THEREOF**" (Date of filing: 12 February 2022 and Application number: 202241007514) Inventors: Sajan Daniel George and Aravind M

2) "**A METHOD FOR PRODUCING OLEOPHILIC, SUPERHYDROPHOBIC, AND SUPERHEMOPHOBIC ARTICLES, AND USES THEREOF"** (Date of filing: 01st April 2022 and Application number: 202241019987) Inventors: Sajan Daniel George, Swithin Hanosh

3) **"A METHOD FOR FABRICATING PLASMONIC WETTABILITY CONTRAST DROPLET ASSAY PLATFORM, AND USES THEREOF"** (Date of filing: 30 May 2022 and Application Number: 202241030933). Inventors: Sajan Daniel George, Vineet P

4) "**A UNIVERSAL METHOD FOR CREATING A NON-ADHESIVE COATING, AND USES THEREOF**" (Date of filing: 13 August 2022 and Application Number: 202241046266) Inventors: Sajan Daniel George, Aravind M, and Alina Peethan

BOOK CHAPTERS

[BC8] S. H. Nannuri, P. Rao, S. Singh, S. K. Misra, S. D. George **Upconversion phenomenon and its implications in core-shell architecture** in Upconversion Nanoparticles for Functional Applications, Eds: Vijay Kumar, Irfan Ayoub, Hendrik C. Swart, and Rakesh Sehgal, Springer Nature (in print)

[BC7] Alina Peethan and Sajan D. George **Laser assisted superhydrophobic coatings** in Advances in Superhydrophobic Coating, **RSC**, Editor: Saji Viswanathan (in preparation)

[BC6] Aravind M and Sajan D. George **Surface wettability and superhydrophobicity** in Advances in Superhydrophobic Coating, **RSC**, Editor: Saji Viswanathan (in preparation)

[BC5] Jijo Lukose, Santhosh Chidangil, Sajan D. George **SERS-based Microfluidics for Real Sample Detection**, IOP publishers (In print)

[BC4] Sajan D. George, **Photothermal probing of plasmonic tailoring of fluorescence emission**, Reviews in Plasmonics, Springer Editor: Chris D. Geddes (In print)

[BC3] Sajan D. George, **Surface-enhanced Raman scattering substrates: Fabrication, properties and applications**, Special Chapter in Self-standing substrates, Editors: Inamuddin, Boddula, Rajender, Asiri, Abdullah M. (Eds.) , Springer, 83-118, (2020)

[BC2] A. Peethan, Unnikrishnan V. K., Santhosh Chidangil, Sajan D. George, **Laser Assisted Tailoring of Wettability: Fundamentals and Applications**, Progress in Adhesion and Adhesives, Kash Mittal (Ed) John Wiley Publishers, 331-366 (2020)

[BC1] Jijo Lukose, Jijo Easo George, Vinaya Kulal, Sajan D. George, Santhosh C., and Rajeev K. Sinha, **Effect of surface pre-treatment methods on cleaning of Au and Ag thin films,** "Industrial applications of Nanostructured Materials"– ISBN 9789385436932, Bloomsburry Publishers, India, 2015.

JOURNAL PAPERS

Published

95) Optimization of different sampling approaches in liquid LIBS analysis for environmental applications
Keerthi; Sajan D George; Joju George Sebastian; Anish Kumar Warrier; Santhosh Chidangil, Unnikrishan V. K.
Journal of Analytical Atomic Spectroscopy (under minor revision) **IF= 4.351**

94) Non-adhesive contrast substrate for single-cell trapping and Raman spectroscopic analysis
A. Peethan, Aravind. M, S. Chidangil, S. D. George
Lab-on-a-Chip (just accepted) **IF= 7.517 - chosen as HOT article of the journal**
https://doi.org/10.1039/D2LC00665K

93) Probing the depth inhomogeneity of spray pyrolyzed CZTS thin films via chemical etching
K Jeganath, Sajan D. George, MS Murari, Raviprakash Y
Inorganic Chemistry Communications, 145, 109952 (2022) **IF= 3.428**
https://doi.org/10.1016/j.inoche.2022.109952

92) Wettability tailored superhydrophobic and oil-infused slippery aluminium surface for improved anti-corrosion performance
A. Peethan, M. Pais, P. Rao, Kulwant Singh, Santhosh Chidangil, Sajan D. George
Materials Chemistry and Physics, 290, 126517 (2022) **IF= 4.778**
https://doi.org/10.1016/j.matchemphys.2022.126517

91) Insights into the mechanically resilient, well-balanced in both productivity and selectivity of polymeric membranes for sustainable wastewater decontamination
Prajwal Sherugar, Srilatha Rao, Madhuprasad Kigga, Sajan D George, Sebastien Deon, Mahesh Padaki
Chemosphere, 306, 135528 (2022) **IF= 8.943**

https://doi.org/10.1016/j.chemosphere.2022.135528

90) Structural, Third Order Nonlinear and Magnetic Properties of Pristine and Ni-doped CuO nanoparticles: Diluted Magnetic Semiconductors P.Soumya Menon; Jibi Kunjumon; Ayona K Jose;

Aleena P.A; Manisha Bansal; G. Vinitha; Tuhin Maity; Priya Mary Abraham; Sajan D. George, Colloids and Surfaces A: Physicochemical and Engineering Aspects, 650, 129582 (2022) **IF=5.518**
https://doi.org/10.1016/j.colsurfa.2022.129582

89) Fluorescence-based detection of mercury ions using carbon dots: Role of synthesis route
S. H. Nannuri, S. Singh, Santhosh. C, S. D. George
Materials Technology: Advanced Performance Materials (just accepted) **IF=3.297**
https://doi.org/10.1080/10667857.2022.2085441

88) Assessing the feasibility of a low-throughput gated echelle spectrograph for Laser-induced Breakdown Spectroscopy (LIBS)-Raman measurements at standoff distances.
M. Muhammed Shameem, V. S. Dhanada, Sajan D. George, V. B. Kartha, C. Santhosh and V. K. Unnikrishnan
Optics and Laser Technology, 153, 108264 (2022) **IF=4.939**
https://doi.org/10.1016/j.optlastec.2022.108264

87) Self-Moisturizing Contact Lens Employing Capillary Flow
Aravind M, S. Chidangil, S. D. George
Additive Manufacturing, 55, 102842 (2022) **IF=11.632 (Widely covered in various media)**
https://doi.org/10.1016/j.addma.2022.102842

86) Microwave-assisted synthesis and upconversion luminescence of $NaYF_4$:Yb, Gd, Er and $NaYF_4$:Yb, Gd, Tm nanorods
S. H. Nannuri, S. Singh, S. K. Misra, Santhosh. C, S. D. George
Methods and Applications in Fluorescence. 10, 024004 (2022) (**Special issue dedicated for Upconversion Nanomaterials**) **IF=3.849** https://doi.org/10.1088/2050-6120/ac58e6

85) Facile fabrication of superhydrophobic gold loaded nanoporous anodic alumina as surface-enhanced Raman spectroscopy substrates
K. S. Choudhari, R. K. Sinha, S. D. Kulkarni, S. Chidangil, S. D. George
Journal of Optics, 24, 044002 (2022) **Invited Original Article**, **IF=2.077**
https://doi.org/10.1088/2040-8986/ac50fe

84) Recent progress in fabrication and optical properties of nanoporous anodic alumina
K. S. Choudhari, C. H. Choi, S. Chidangil and S. D. George
Nanomaterials, 12 (3), 444 (2022) **IF=5.719**
https://doi.org/10.3390/nano12030444

83) Effect of Stacking Sequence on the Structural Ordering and Phase Formation in the Sequentially Deposited CZTS Thin Films
N. J. Chouhdari, S. D. George and Raviprakash Y
International Journal of Energy Research, 47(6), 7758-7774 (2022) **IF=4.672**
https://onlinelibrary.wiley.com/doi/abs/10.1002/er.7678

82) Thermal annealing and doping induced tailoring of phase and upconversion luminescence of NaYF4:Yb Er microcrystals
S. H. Nannuri, S. Adan, Subash C. K, Santhosh C, S. D. George
Nanoscale and Microscale Thermophysical Engineering , 1- 16 (2022) **IF=4.629 Cover Article**
https://doi.org/10.1080/15567265.2022.2028044

81) Influence of Sulfurization Time and Cu-ZnS-Sn Stack Order on the Properties of Thermally Evaporated CZTS Thin Films
N. J. Chouhdari, S. D. George and Raviprakash Y
Journal of Materials Science: Materials in Electronics , 21 Jan (2022) **IF= 2.779**
https://doi.org/10.1007/s10854-022-07729-5

80) Role of geometric configurations in optimizing the LIBS signal enhancement
Keerthi, S. D. George, R. Nayak , S. Chidangil, Unnikrishnan V. K
Optik, 258, 168387 (2022) **IF=2.840**
https://doi.org/10.1016/j.ijleo.2021.168387

79) Elemental analysis of liquid samples by Laser Induced Breakdown Spectroscopy (LIBS): Challenges and potential experimental strategies
Keerthi, S. D. Kulkarni, S. D. George, S. Chidangil, Unnirkishnan V. K.
Optics and Laser Technology, 147, 107622 (2022) **IF=4.939**; - **Most downloaded article of March 2022**
https://doi.org/10.1016/j.optlastec.2021.107622

78) Facile fabrication of plasmonic wettability contrast paper surface for droplet array-based SERS sensing
A. Peethan, Aravind. M, Unnikrishnan. V.K, S. Chidangil, S. D. George
Applied Surface Science, 571, 15188 (2022) **IF=7.392**
https://doi.org/10.1016/j.apsusc.2021.151188

77) Biomass-derived versatile activated carbon removes both heavy metals and dye molecules from wastewater with near-unity efficiency: Mechanism and Kinetics
Prajwal Sherugar, Nagaraj S. Naik, Sajan D. George, Dharmapura H. K. Murthy, Mahesh Padaki
Chemosphere 287 (2), 132085 (2022) **IF=8.943**
https://doi.org/10.1016/j.chemosphere.2021.132085

76) Subcellular imaging and diagnosis of cancer using engineered nanoparticles
Shivanand H Nannuri, Ajinkya N. Nikam, Abhijeet Pandey, Srinivas Mutalik and Sajan D. George
Current Pharmaceutical Design, 28 (9), 690-710 (2022) (**Invited Review Article**), **IF=3.310**
DOI : 10.2174/1381612827666210525154131

75) Development and performance evaluation of a multi-modal optical spectroscopic sensor
V. S. Dhanada, K. S. Choudhari, S. D. George, V. B. Kartha, C. Santhosh and Unnikrishnan V. K
Journal of Analytical Atomic Spectrometry, 36, 2391-2403 (2021) **IF=4.023**
https://doi.org/10.1039/D1JA00242B

74) Interfacial Adsorption of Nanoparticles of Maltodextrin for Enhanced Protection of Metal Surface
Mikhitha Pais, Padamaltha Rao, Sajan D. George
Surfaces and Interfaces, 26, 10418 (2021) **IF=4.837**
https://doi.org/10.1016/j.surfin.2021.101418

73) Nanoparticle Impregnated Self-Supporting Gel for Enhanced Reduction in Oxidative Stress: A Molecular Dynamics Insight for Lactoferrin-Polyphenol Interaction
Ruchira Rachaudhuri, Abhijeet Pandey, Subham Das, Shivanand H. Nannuri, Alex Joseph, Sajan D. George, Anita P. Vincent, Srinivas Mutalik,
International Journal of Biological Macromolecules, 189, 100-113 (2021) **IF=6.953**
https://doi.org/10.1016/j.ijbiomac.2021.08.089

72) A broadband optical pH sensor using upconverison luminescence
Suresh. K, A. Bankapur, S. Chidangil, H. Madyastha, S-K Kentaro, Sajan D. George
Journal of Materials Chemistry C, 9, 8606-8614 (2021) **IF=7.393**
https://doi.org/10.1039/D1TC00792K

71) A novel microfluidic device with tapered sidewall electrodes for efficient ternary blood cells (WBCs, RBCs and PLTs) separation
M. Kumar, A. Kumar, S. D. George, and K. Singh
Measurement Science and Technology, 32, 115106 (2021) **IF=2.046**
https://doi.org/10.1088/1361-6501/ac0f24

70) Human Tear Fluid Analysis for Clinical Applications: Progress and Prospects
S. S. Adigal, A. Rizvi, N. V. Rayroth, A. Barik, S. Bhandari, S. D. George, J. Lukose, V. B. Kartha, S. Chidangil
Expert Reviews in Molecular Diagnostics, 21 (8), 767-787 (2021). **IF=5.225**
https://doi.org/10.1080/14737159.2021.1941879

69) Enhanced Visible/NIR driven catalytic activity in presence of neodymium (Nd3+), for Yb3+ and Tm3+ doped NaYF4 nanoparticles, Simranjit Singh, Shivanand H. Nannuri, Sajan D. George, Superb Misra
Journal of Environmental Chemical Engineering, 9, 105813 (2021) **IF=5.905**
https://doi.org/10.1016/j.jece.2021.105813

68) Photonics of human saliva: potential optical methods for the screening of abnormal health conditions and infections
Jijo Lukose, Sanoop Pavithran, Ajaykumar Barik, Keerthilatha M. Pai, Unnikrishnan V. K, Sajan D. Geroge, V. B. Kartha, Santhosh Chidangil
Biophysical Reviews, Jun2, 1-27 (2021) **IF=4.911**
doi:https://doi.org/10.1007/s12551-021-00807-8

67) Effect of Sulfurization Temperature on Cu-Zn Disorder for Non-Stoichiometric Spray Pyrolysed Cu2ZnSnS4 Thin Films
Jeganath K, Sajan D. George, MS Murari, Raviprakash Y
Materials Letters, 300, 130168 (2021) **IF=3.423**
https://doi.org/10.1016/j.matlet.2021.130168

66) Glycogen nanoparticles as a potential corrosion inhibitor
Mikhitha Pais, Padamalatha Rao, Sajan D. George
International Journal of Biological Macromolecules, 182, 2117-2129 (2021) **IF=6.953**
https://doi.org/10.1016/j.ijbiomac.2021.05.185

65) Effect of metal ions on the thermo-optic properties of Rhodamine 6G-gold nanoparticle hybrids
J. John, A. Kurian, S. D. George
Optik, 241, 166988 (2021) **IF= 2.443**
https://doi.org/10.1016/j.ijleo.2021.166988

64) Laser-induced assembly of biological cells and colloids onto a candle soot coated substrate
Monisha. K, A. Bankapur, S. Chidangil, S. D. George
Colloids and Surface A : Physiochemical and Engineering aspects, 616, 126357 (2021) **IF=4.539** https://doi.org/10.1016/j.colsurfa.2021.126357

63) ZIF-8@Protein-Titanocene Nanocomposite Core-Shell MOFs for Efficient Therapy of Neuroblastoma: Optimization, Molecular Docking, and Toxicity Studies
Abhijeet Pandey, Sanjay Kulkarni, Ajinkya Nikam, Fayaz Shradgan, Shivanand H Nannuri, Sajan D George, Anita P. Vincent, Srinivas Mutalik
International Journal of Biological Macromolecules, 178, 444-463 (2021) **IF=6.953**
https://doi.org/10.1016/j.ijbiomac.2021.02.161

62) Optical technologies for the detection of viruses like COVID-19: Progress and prospects
J. Lukose, S. Chidangil, Sajan D. George
Biosensors and Bioelectronics,178,113004 (2021), **IF=10.618 Most cited and downloaded article of the month**
doi: 10.1016/j.bios.2021.113004

61) Hybrid LIBS-Raman-LIF systems for multi-modal spectroscopic applications: A topical review
Dhanada V. S, Sajan D. George, Kartha, V. B, Santhosh Chidangil, Unnikrishnan V. K
Applied Spectroscopy Reviews, 56, 463-491 (2021) , **IF=5.917**
DOI: 10.1080/05704928.2020.1800486

60) Hyaluronic acid-drug conjugate modified core-shell MOFs as pH responsive nanoplatform for multimodal therapy of Glioblastoma A. Pandey, S. Kulkarni, A. P. Vincent, S. H. Nannuri, Sajan D. George, Srinivas Mutalik
International Journal of Pharmaceutics, 588, 119735 (2020) **IF=4.85**
https://doi.org/10.1016/j.ijpharm.2020.119735

59) Copper Sulphide Based Heterogeneous Nanoplatforms for Multimodal Therapy and Imaging of Cancer: Recent Advances and Toxicological Perspectives
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2) Investigation of transport properties of doped GaAs epitaxial layers using an open photoacoustic cell
S. D. George*, S. Dilna, P. S. Kumar, P. Radhakrishnan, V. P. N. Nampoori, C. P. G. Vallabhan
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1) Thermal characterization of doped InP using photoacoustic technique
S. D. George, A. Kurian, M. Lase, V. P. N. Nampoori, C. P. G. Vallabhan
Proceedings of SPIE International Society for Optical Engineering, Vol. 4595 pp 183-191 (2001)
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Refereed International Conferences

1) B. Rajesh Kumar, N. Shemeena Basheer, Achamma Kurian, and **Sajan D George**, "Effect of particle size on thermo-optic properties of gold nanofluids - A thermal lens study" International Conference on Optoelectronic Materials and Thin Films for Advanced Technologies (OMTAT 2013), CUSAT, Kochi, India (2013)
2) Subramanyan Namboodiri Varanakoottu, **Sajan Daniel George**, Steffen Hardt, "Optical trapping in a microfluidic channel", Optofluidics 2013, Hong Kong (In Proc: Optofluidics, pp 78-79(2013).
3) Subramanyan Namboodiri Varanak0ottu, **Sajan Daniel George**, Steffen Hardt, "Light actuated Marangoni tweezers for the manipulation of microparticles and biological cells", International Conference Soft Control – Switching surface properties with stimuli responsive softmatter, TU Darmstadt, Germany (2013)
4) N. Shemeena Basheer, B. Rajesh Kumar, Achamma Kurian, and **Sajan D George**, "Concentration dependent thermal diffusivity measurement of silver nanofluids using dual beam thermal lens technique " International Conference on Optoelectronic Materials and Thin Films for Advanced Technologies (OMTAT 2013), CUSAT, Kochi, India (2013)
5) B. Rajesh Kumar, N. Shemeena Basheer, Achamma Kurian, and **Sajan D George**, "Thermal diffusivity of ethylene glycol gold nanofluid mixtures measured using dual beam thermal lens

technique" International Conference on Materials Science and Technology (ICMST - 2012), Pala, Kerala, India (2012)

6) N. Shemeena Basheer, B. Rajesh Kumar, Achamma Kurian, and **Sajan D George**, "Thermal conductivity measurement of organic liquids incorporated with silver nanoparticle using photothermal technique" International Conference on Materials Science and Technology (ICMST - 2012), Pala, Kerala, India (2012)

7) Steffen Hardt, Subramanyan Namboodiri Varanakkottu, **Sajan George,** Tobias Baier, Martina Ewald, and Markus Biesalski "Optically controlled Marangoni Tweezers" Bulletin of the American Physical Society 65th Annual Meeting of the APS Divison of the Fluid Dynamics, vol. 57, no. 17, November 18-20; San Diego, California (2012)

8) Subramanyan Namboodiri Varanakkottu, **Sajan Daniel George,** Tobias Baier, Steffen Hardt, and Markus Biesalski "Marangoni trap a smart surface' 19th INternational Symposium on Surfactants in Solution (SIS 2012), June 24-28, University of Alberta, Edmonton, Canada (2012)

9) **Sajan D George** and Steffen Hardt, "Effect of concentration on the optical contact angle switching of a droplet containing azobenzene", Workshop on Introduction to Optofluidics, International Center for Theoretical Physics, Trieste, Italy (2009)

10) P. Menon, R. Rajesh, S. Longuemart, **S. George**, J. Thoen, and C. Glorieux, "Wide bandwidth photopyrocalorimetry of glassy liquids" International Conference on Photoacoustic and Photothermal Phenomena, Cairo, Egypt, January 6-9 (2007)

11) Sujtha, Lavanya Rai, Prathap Kumar B. R. Krishnanand, K. K. Mahato, **Sajan D George**, V. B. Kartha and C. Santhosh "Protein profile study of papsmear and biopsy of cervix tissue using High Performance Liquid Phase Chromatography (HPLC) - Laser Induced Fluorescence (LIF) technique", First Asian Spectroscopy Conference and Asian Biospectroscopy Conference, 29th January - 3rd February, Indian Institute of Science, Bangalore (2007)

12) Gopal R Karemore, Sujatha, Lavanya Rai, Prathap Kumar B. R. Krishnanand, K. K. Mahato, **Sajan D George**, V. B. Kartha and C. Santhosh "Fuzzy clustering of protein profile using High Performance Liquid Phase Chromatography (HPLC) - Laser Induced Fluorescence (LIF) technique", First Asian Spectroscopy Conference and Asian Biospectroscopy Conference, 29th January - 3rd February, Indian Institute of Science, Bangalore (2007)

13) Sujatha, Lavanya Rai, B. R. Krishnanand, K. K. Mahato, **Sajan D George**, V. B. Kartha and C. Santhosh "Protein profile study of papsmear and biopsy tissue of cervix" International Conference on Radiation Biology, Nov 22-26, Banaras Hindu University, India, (2006)

14) **Sajan D George**, A. K. George, P. Radhakrishnan, V. P. N. Nampoori and C. P. G. Vallabhan "Complete thermal characterisation of liquid crystals using laser induced photoacoustic technique" Proceedings of Photonics, 2006, December 13-16, Hydrebad, Photonics (2006)

15) Stijn Pittois, **Sajan D George**, Jan Thoen and Christ Glorieux, "Thermal conductivity of liquids filled with nanoparticles" Proceedings of International Symposium on Thermophysics (Pages 680-681), Boulder, Colarado (2006)

16) **Sajan D George**, Rajesh Komban, K. G. K. Warrier, P. Radhakrishnan, V. P. N. Nampoori and C. P. G. Vallabhan, Proceedings of International Symposium on Thermophysics (Page 282), Boulder, Colarado (2006)

17) Stijn Pittois, **Sajan D George**, Katleen Denolf, Jyotsna Ravi, Jan Thoen and Christ Glorieux, Photopyrolectric determination of thermal condutivity and effusivity of complex liquids, 17th European Conference on Thermophysical properties (2005)

18) Achamma Kurian**, Sajan D George**, V. P. N. Nampoori and C. P. G. Vallabhan Study of the effect of electronic energy transfer of pH in organic dye mixtures using dual beam thermal lens technique Photonics 2004, Kochi, December (2004)

19) **Sajan D. George**, P. Radhakrishnan, V. P. N. Nampoori and C. P. G. Vallabhan, Investigation of transport properties of intrinsic semiconductors using open cell photoacoustic technique Photonics 2004, Kochi, December (2004)

20) **Sajan D George**, A. K. George, P. Radhakrishnan, V. P. N. Nampoori and C. P. G. Vallabhan, Thermal characterisation of liquid crystal mixtures using phtooacoustic techique, Photonics 2004, Kochi, December (2004)

21) A. Deepthy, D. Ambika, **Sajan D George**, V. Kumar, V. P. N. Nampoori and C. P. G. Vallabhan Third order nonlinear optical properties of ZnO thin films using Z.scan technique ,Photonics 2004, Kochi, December (2004)

22) **Sajan D George**, P. Radhakrishnan, V. P. N. Nampoori and C. P. G. Vallabhan, Laser induced nondestructive evaluation of transport properties of intrinsic and doped Si, International Conference on Laser Applications ICLAOM Optical Metrology, IIT Delhi (2003)

23) Achamma Kurian, **Sajan D George**, V. P. N. Nampoori and C. P. G. Vallabhan, Determination of molecular distance in organic dye mixtures using dual beam thermal lens technique. Photonics 2002, TIFR, India (2002)

24) **Sajan D George**, S. Dilna, A. K. George, P. Radhakrishnan, V. P. N. Nampoori and C. P. G. Vallabhan Use of Photoacoustic technique to measure the thermal diffusivity and phase transition in iquidcrystals,Photonics2002,TIFR,India(2002).

Major Research Areas

1) Surface Engineering for photonics and microfluidics applications

In this project, I utilized a femtosecond laser to create hierarchical micro/nanoscale patterns on the surface of different kinds of materials so that surface roughness can be controlled without chemical modifications. Such patterns on quartz are used for the well-defined biological cell alignment [1], creating superhydrophobic and superaerophobic surfaces [2-3]. This was the first demonstration of superhdyrophobic surfaces that exhibit underwater superaerophobicity. Further such surfaces are used for droplet transport across surfaces for the open microfluidic applications [4] as well as for fabricating the flexible superhydrophobic surface-enhanced Raman scattering that allows femtomolar detection of the analyte molecule via concentration enrichment [5]. Further, by chemically modifying the polymer surface via oxygen plasma treatment, the control of air bubble dynamics onto the surface was demonstrated [6]. The use of air-bubble mediated capillary forces to control the motion of floating objects at the air-water interface was also shown [7]. Recently, an omniphobic nanoporous alumina surface was created via evaporative deposition of poly(dimethylsiloxane) [8]. The work on wettability contrast and the slippery surface for photonics, environmental and biomedical applications are in progress [9-13].

1) Applied Surface Science,305, 375-381 (2014)
2) Materials and Design, 100, 8-18 (2016)
3) Advanced Materials and Interfaces, 1601088 (2017)
4) ACS Applied Materials and Interfaces 9(33), 28046-28054 (2017)
5) Sensors and Actuators B: Chemical, 272, 485-493 (2018)
6) Applied Surface Science, 410, 117-125 (2017)
7) Advanced Materials and Interfaces, 1601088 (2017) (Wiley HOT article)
8) Bulletin of Materials Science, 43, 193 (2020)- (Invited Original Article)
9) International Journal of Biological Macromolecules, 182, 2117-2129 (2021)
10) Surfaces and Interfaces, 26, 10418 (2021)
11) Applied Surface Science, 571, 15188 (2022)
12) Journal of Optics, 24, 044002 (2022)
13) Additive Manufacturing (just accepted)

2) Development of light assisted particle-manipulation techniques

In this project, I develop light-assisted manipulation techniques to control the single object as well as colloidal particles. One of the interesting works involves the trapping and manipulation of the particles by utilizing the surface tension change that occurs at the liquid-air interface due to localized photoswitching of an azobenzene molecule from the cis to trans-state and vice versa. The surface tension change-induced Marangoni flow was used to trap the single-particle and manipulation of the particle using the developed photochemical tweezers was demonstrated [1]. In another recent work, we demonstrated that by heating the bio-compatible cost-effective candle soot film using an extremely low-power laser, it is possible to trap a single biological cell as well as a colloidal particle via optothermophoretic forces [2]. In addition, it

has been demonstrated that by controlling the laser parameters, it is possible to create the localized assembly of biological cells as well as colloidal particles. The advantage of the reported candle soot-assisted optothermophoretic trapping technique compared to other reported plasmonic substrate-assisted thermophoretic trapping techniques is that the developed approach is wavelength-independent. In another particle manipulation technique, we designed and assembled an optical tweezer setup that is coupled with upconversion fluorescence spectral measurement and Raman spectroscopy. Using such a setup, we demonstrated the potential of PEI capped upconversion particle for the accurate pH measurement in a flowing medium of biological fluids [3]

1) Angewandte Chemie Int. Edition, 52, 7291-7295 (2013) (DOI: 10.1002/anie.201302111) Wiley HOT article - Surfaces and Interfaces
2) Colloids and Surface A: Physicochemical and Engineering Aspects, 616, 126357 (2021)
3) An optically trapped upconversion particle luminescence-based pH sensor (accepted in Journal of Materials Chemistry C)

3) Photothermal techniques and their applications

Since my doctoral days, I have been working on three photothermal techniques such as photoacoustic [1-3], photothermal deflection [4-5], and thermal lens technique [6-8]. The photoacoustic technique has been used to investigate the thermal and transport properties of intrinsic and doped semiconductors [1-3, 9], conducting polymers [10], porous ceramics [11], liquid crystals [12], single crystals [13], nanocomposites [14], etc. On the other hand, photothermal deflection is used to investigate the heat transport through intrinsic and doped semiconductors as well as multi-layered superlattices [4-5]. The application of the thermal lens technique has been further extended to investigate the plasmonic control of emission properties of fluorophores as well as energy transfer studies[16-20]. Recently, the laser-induced photothermal effect is exploited for crystallization [21-22] and heavy metal detection [23].

1) Physica Status Solidi (a), 195 (2), 416-421 (2003)
2) Journal of Physics D: Applied Physics, 36 (8), 990-993 (2003)
3) Physica Status Solidi (a), 196(2), 384-389 (2003)
4) Applied Physics B: Lasers and Optics, 77, 633-637 (2003)
5) Physical Review B, 68 (16), 165319 (2003) [selected on virtual journal of ultrafast science, Nov. 2003].
6) Spectrochimica Acta part A: Molecular and Biomolecular Spectroscopy, 59, 487-491 (2003)
7) Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy, 61 (13-14), 2799 -2802 (2005)
8) Spectrochimica Acta Part A:Molecular and Biomolecular Spectroscopy, 67, 3-4, 678-682 (2007)
9) Physica Status Solidi (a), 196(2), 384-389 (2003)
10) Physical Review B, 69, 235201 (2004)
11) International Journal of Thermophysics, 28(1), 123 - 132 (2007)
12) Smart Materials and Structures, 16 (4), 1298-1301 (2007)
13) Materials Research Bulletin, 43, 1641-1648 (2008)
14) Journal of Luminescence, 137, 225-229 (2013)
15) Applied Physics B: Lasers and Optics, 113 (4), 581-587 (2013)
16) Applied Physics B: Laser and Optics, 115, 335-342 (2014)
17) Journal of Thermal Analysis and Calorimetry, 119, 453-460 (2015)

18) Physical Chemistry Chemical Physics,17,15816-15821 (2015)
19) Journal of Luminescence, 172,39-46 (2016)
20) RSC Advances, 6(7), 62390-62398 (2016)
21) Photochemistry and Photobiological Sciences, 16, 870-882 (2017)
22) Scientific Reports, 8, 16018 (2018)
23) Optik,241, 166988 (2021)

4) Biomedical Spectroscopy

In this area, I am working on the usage of lab-assembled spectroscopic tools for the investigation of clinical or clinically relevant samples. A high performance liquid phase chromatography-laser induced fluorescence system has been explored for the body fluid analysis, particularly for the pap smear analysis of patients with cervical cancer [1]. The same technique was further explored for protein profiling of breast and oral cancer patients [2-3]. Further, by using the multivariate statistical tools, we explored the laser-induced fluorescence technique as a tool for the early detection of colon cancer [4]. Recently, a hybrid laser-induced breakdown spectroscopy-Raman spectroscopy system was used for mineralogical applications which can be extended for biological samples also [5]. Of late, the research is focused on the development of nanoplaforms for biomedical and therapeutical applications [6-9]

1) Proceedings of SPIE, Vol 6441, Imaging, Manipulation and Analysis of Biomolecules, Cells and Tissues, 64410B (2007)
2) Proceedings of SPIE, Vol 6430, Advanced Biomedical Clinical Systems V, 64300 W (2007)
3) Journal of Biomedical Optics, 15, 067007 (2010)
4) Journal of Chemometrics, 22, 408 - 416 (2008)
5) Talanta, 208, 12482 (2020)
6) Langmuir, 35, 31, 10139-10150 (2019
7) Coordination Chemistry Reviews, 419, 213356, (2020)
8) International Journal of Pharmaceutics, 588, 119735 (2020)
9) International Journal of Biological Macromolecules 178, 444 (2021)

5) Development of novel nanoparticles and nanostructures for sensors

In pursuit of developing novel sensors, we have been developing new nanoparticles that include upconversion nanoparticles [1-2], quantum dots [3], nanoporous silica [4], nanoparticles of biological macromolecules [5], and nanoporous alumina [6-8], etc. In the case of upconversion particles, the role of synthesis conditions, as well as post-annealing conditions and doping on the emission properties have been investigated to optimize the particles for deep tissue imaging [1-2]. The quantum dots were explored for sensitive heavy metal detection by exploiting the energy transfer mechanism between the fluorophores [3]. In addition, the control of emission properties of a fluorophore by tailoring the decoration method of plasmonic nanoparticles into mesoporous silica has been demonstrated [4]. Recently, we showed that nanoparticles of biological macromolecules have better anti-corrosive properties as compared to their bulk counterpart [5]. In our studies, we investigated the less explored area of controlling the optical properties of nanoporous alumina by controlling the synthesis conditions [5-8]. Such control can find applications in developing tunable photonic bandgap materials as well as biosensors.

1) RSC Advances, 9, 964-9372 (2019)

2) Journal of Alloys and Compounds, 777, 894-901 (2019)
3) Journal of Nanoparticle Research, 20, 232 (2018)
4) Microporous and Mesoporous Materials, 244, 171-179 (2017)
5) International Journal of Biological Macromolecules (accepted)
6) Nano-structures and Nano-objects, 19, 100354 (2019)
7) ECS Journal of Solid State Science and Technology, 7(11), R175-R182 (2018)
8) Microporous and Mesoporous Materials, 271, 138-145 (2017)