



S N BOSE NATIONAL CENTRE
FOR BASIC SCIENCES

Block JD, Sector III, Salt Lake, Kolkata 700 106

DEPARTMENTAL SEMINAR

Chemical and Biological Sciences

25th September, 2024

4.00 PM

ONLINE / FERMION

SPEAKER



Dr. Santosh Gupta,

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Short bio :

Dr. Santosh Gupta joined 53rd Batch of Bhabha Atomic Research Centre (BARC) Training School in Chemistry Discipline and after successful completion of one-year Orientation Training Course; he joined the Radiochemistry Division (RCD), BARC in 2010. He has contributed significantly in studies of materials using Photoluminescence Spectroscopy and his R& D work is focused on designing light emitting materials for health, energy and environment. His research work has resulted in more than 260 peer reviewed international journal papers with close to 6700 citations, h-index 50 and i-10 index 146. Dr. Gupta is the recipient of several awards notable among them are Fulbright, Indo-US and JSPS Fellowship, Department of Atomic Energy (DAE) and Scientific India Young Scientist award, Indian Association of Nuclear Chemists and Allied Scientists (IANCAS) Dr. Tarun Datta Memorial Medal, Society of Materials Chemistry (SMC) Bronze medal, Fulbright Outreach Lecturing Fund (OLF) Award and Chirantan Rasayan Sanstha (CRS) silver medal.

He has received Royal Society of Chemistry certificate for among 10 % most cited authors and International Centre for Diffraction Data (ICDD) certificate for JCPDS, Powder Diffraction File. He was featured in Top 2% most Influential scientists worldwide based on the Scopus publications impact consecutively for the year 2020, 2021 and 2022 prepared by Prof. John PA Loannidis of Stanford University and his team and published by Elsevier.

TITLE OF THE TALK

Phosphor Converted Light Emitting Diodes

ABSTRACT

Lighting consumes 15% of the world's total energy and is responsible for 5% of the world's total greenhouse gas emissions. Population growth and increased urbanization are expected to increase lighting demand by 50% before 2030. However, light-emitting diodes (LED) and other advanced lighting technologies can reduce lighting power consumption by half due to their high efficiency. This can potentially reduce carbon dioxide emissions by 800 million tons per year, which is equivalent to 684 coal-fired power plants. Phosphor-converted white light-emitting diodes (pc-WLEDs) are excellent energy-efficient light sources for artificial lighting applications. One goal of artificial lighting is to make objects/images look natural – as they look under the sunlight. We have designed various doping and defect induced pcLEDs with excellent color rendering index (CRI), thermal stability, correlated color temperature (CCT), color chromaticity, quantum efficiency and electroluminescence (EL) in a variety of inorganic materials. These include pyrochlore, garnets, spinels, etc. with various dopant ions such as Sm 3+, Eu 3+, Cr 3+, Mn 2+, etc [1-5]. Y 3 Al 2 Ga 3 O 12 :Cr 3+ phosphor was explored to fabricate NIR pc-LED which exhibited efficient electroluminescence for potential applications in imaging and night vision. [2] We have used Sc 2 Mo 3 O 12 :Sm 3+ reddish-orange emitting phosphor for fabricating pc-WLEDs.[3] The WLED offers a high color rendering index (CRI) of 84, CIE (0.33, 0.32), and correlated color temperature (CCT) of 5408 K, with high luminous efficacy of 113 lm/W. Y 2 Zr 2 O 7 :Eu 3+ NPs was employed to fabricate warm white light pc-LED with a correlated color temperature (CCT) of 4164 K, color rendering index (CRI) of 78, and CIE of 0.358, 0.309 which is the ultimate requirement for ideal indoor lighting [4]. We have also demonstrated defect induced tunable light emitting diodes of compositionally modulated zinc gallium germanium oxides [5].

References:

1. R.T. Parayil and S.K. Gupta et al. *Materials Advances* 2023, 4, 5594-5604
2. Annu Balhara and S.K. Gupta et al. *Journal of Materials Chemistry C* 2024, 12, 9716 - 9732
3. Annu Balhara and S.K. Gupta et al. *Journal of Materials Chemistry C* 2024, DOI: 10.1039/D4TC01817F
4. Annu Balhara and S.K. Gupta et al. *Journal of Materials Chemistry C* 2024, 12, 1728-1745
5. S.K. Gupta et al. *Chemical Engineering Journal*, 2023, 474, 145595