



Ph.D. viva-voce exam of Sujeet Kumar (19DR0159) in the Raman Hall on 07-10-2026 (Wed) at 11:30 AM

1 message

P. M. Sarun <sarun@iitism.ac.in>

Wed, Sep 30, 2026 at 9:50 AM

To: Head Physics <phy@iitism.ac.in>, Saurav Chandra <saurav@iitism.ac.in>, "Faculty, Physics" <facphys@iitism.ac.in>, Rahul Gupta <rahulgupta@iitism.ac.in>, Amish Gautam <amish@iitism.ac.in>, Bobby Antony <bobby@iitism.ac.in>, Kaushal Kumar <kkumar@iitism.ac.in>, R Thangavel <rthangavel@iitism.ac.in>, Ganesh Nayak <gcnayak@iitism.ac.in>, Bhukya Naick <krishna2bk2ee@iitism.ac.in>, Sujeet Kumar <sujeet.19dr0159@ap.iitism.ac.in>, SUJEET VERMA <sujeetverma191@gmail.com>, DPGC Physics <dpgc-physics@iitism.ac.in>, "Employee IIT(ISM)" <emp@iitism.ac.in>
Cc: Dobbidi Pamu <pamu@iitg.ac.in>, Dean Academic <dacad@iitism.ac.in>, "Assoc. Dean PG IIT (ISM) Dhanbad" <adpg@iitism.ac.in>

Dear All,

The Ph.D. viva-voce examination of Sujeet Kumar (19DR0159) will be held on 07-10-2026 (Wednesday) at 11:30 AM in the Raman Hall, Department of Physics, for the Ph.D. thesis entitled **"STUDIES ON THE STRUCTURAL, FERROELECTRIC, DIELECTRIC, AND IMPEDANCE PROPERTIES OF RARE-EARTH (Nd, Pr, Eu) MODIFIED BISMUTH FERRITE CERAMICS ACROSS 50-500 °C"**

All the faculty members in the department, research scholars, students, and the DSC members of Mr. Sujeet Kumar are requested to attend the event. The examiner has expressed his desire to be physically present in the department to conduct the viva-voce examination.

DSC Members:

1. Prof. Bobby K. Antony, Chairman,
2. Prof. K. Kumar, Member from the Department
3. Prof. R. Thangavel, Member from the Department
4. Prof. G. C. Nayak, Member from the Sister Department
5. Prof. B. K. Naick, Member from the Sister Department

Abstract of the thesis:

Bismuth ferrite (BiFeO₃, R3c space group) is one of the most promising single-phase multiferroic materials, exhibiting ferroelectricity and antiferromagnetism simultaneously at room temperature, with a high Curie temperature (~ 830 °C) and Neel temperature (~370 °C). These unique properties make BiFeO₃ attractive for multifunctional applications. However, BiFeO₃ suffers from high leakage current, weak magnetization, and structural instability due to oxygen vacancies and secondary phases, which limit its practical utility. Rare-earth doping at the Bi site has emerged as an effective strategy to tune lattice changes, stabilize the perovskite phase, and suppress leakage currents. In this work, systematic investigations were carried out on Nd, Pr, and Eu doped BiFeO₃ ceramics, with compositions Bi_{1-x}RE_xFeO₃ (x = 0.00–0.10), across a wide temperature range of 50–500 °C. Structural analysis using XRD and Rietveld refinement confirms phase stabilization and suppression of impurity phases upon rare-earth substitution. Raman and XPS spectroscopy reveal modifications in local bonding environments and phonon dynamics, while FESEM shows reduced grain size and porosity with increasing dopant concentration. The tolerance factor shows ionic radius mismatch (Nd³⁺: 1.27 Å, Pr³⁺: 1.29 Å, Eu³⁺: 1.25 Å versus Bi³⁺: 1.36 Å) plays a crucial role in lattice contraction. Dielectric measurements show that the dielectric constant and loss tangent increase with increasing dopant concentration at elevated temperatures. Impedance and modulus spectroscopy reveal improved relaxation dynamics. Nyquist plots confirm reduced grain boundary resistance and improved conduction pathways, highlighting the role of rare-earth doping in tailoring electrical transport. Ferroelectric measurements show enhanced polarization stability and reduced leakage current, positioning them as strong candidates for high-temperature ferroelectric applications. The findings demonstrate that Nd, Pr, and Eu doping effectively overcome the intrinsic limitations of BiFeO₃, enabling reliable performance across 50–500 °C. These results pave the way for integrating doped BiFeO₃ ceramics into multifunctional devices, including energy storage systems, high-temperature sensors, spintronic components, and photovoltaic platforms.

With best regards

Prof. P. M. Sarun
Ph.D. Supervisor

Enc:

@Saurav Chandra: For booking Raman Hall for the purpose.
HoD, Physics, Dean (Acad), Associate Dean (PG), DPGC convener,
Dept. Faculty, Examiner, Sujeet, DSC members

--

Prof. Sarun P. M., Ph.D. CUSAT & NIIST (CSIR),
Associate Professor,
Functional Ceramics Laboratory, Department of Physics,
IIT (ISM) Dhanbad, Jharkhand, INDIA - 826004.
Ph: +91-326-2235887 (O); +91-9471191816 (Mob);
e-mail: sarun@iitism.ac.in