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Notice for the PhD Viva Voce Examination

Ms Sandra Mathew (Registration Number: 2170245), PhD scholar at the School of Sciences, CHRIST (Deemed to be University), Bangalore will defend her PhD thesis at the public viva-voce examination on Monday, 12 May 2025 at 11.00 am in Room No. 044, Ground Floor, R & D Block, CHRIST (Deemed to be University), Bengaluru - 560029.

Title of the Thesis	:	**Titanium Mxene Based Composites for Energy and Environmental Applications**
Discipline	:	**Chemistry**
External Examiner - I	:	**Dr Sudhanshu Sharma** Associate Professor IIT Gandhinagar Palaj Campus, Palaj, Near GIFT City Gandhinagar - 382355 Gujarat
External Examiner – II	:	**Dr Sanjeev P Maradur** Associate Professor Materials Science & Catalysis Division Poornaprajna Institute of Scientific Research (PPISR) No 4, 16th Cross, Sadashiva Nagar Bengaluru - 560080 Karnataka
Supervisor	:	**Dr Sunaja Devi K R** Professor Department of Chemistry School of Sciences CHRIST (Deemed to be University) Bengaluru-560029 Karnataka

The members of the Research Advisory Committee of the Scholar, the faculty members of the Department and the School, interested experts and research scholars of all the branches of research are cordially invited to attend this open viva-voce examination.

Registrar

Place: Bengaluru
Date: 7 May 2025

ABSTRACT

The rise in energy consumption, driven by technological advancements and industrial activities, has led to environmental challenges such as water contamination and pollution, posing threats to human health and ecosystems. This highlights the urgent need for sustainable energy solutions. Hydrogen, as a renewable energy source, holds promise in addressing the energy crisis, with electrochemical water splitting. Supercapacitors, with their rapid charge/discharge, long life cycle, and high-power density, excel as energy storage devices. MXenes, derived from MAX phases, have gained recognition for their unique properties in energy and environmental applications. However, challenges such as self-oxidation and layer restacking limit their broader use. To overcome these issues, MXenes are integrated with heteroatoms, carbon nanomaterials, metal oxides, and sulfides as interlayer spacers. This study highlights the significant improvements in energy generation, storage, and environmental applications achieved through such strategic combinations, paving the way for sustainable solutions.

Keywords: Ti_3C_2 MXene; Water splitting; Hydrogen Evolution Reactions; Supercapacitors; Photocatalysis; Dye degradation

Publications:

1. **Sandra Mathew,** Sunaja Devi K R, Rationally designed CeO_2 decorated Ti_3C_2 MXene interface for efficient water splitting and enhanced supercapacitor performance, Colloids Surfaces A Physicochem. Eng. Asp. 684 (2024) 133170. https://doi.org/10.1016/j.colsurfa.2024.133170.
2. **Sandra Mathew,** Sunaja Devi K R, MnO_2 anchored N–Ti_3C_2 MXene as a bifunctional electrode for enhanced water splitting, Int. J. Hydrogen Energy. 71 (2024) 1283–1292. https://doi.org/10.1016/j.ijhydene.2024.05.323.
3. **Sandra Mathew,** Madhushree R. and Sunaja Devi K. R., $CoFe_2O_4$ /g-C_3N_4 intercalated Ti_3C_2 MXene for efficient electrocatalytic hydrogen evolution reaction, Sustain. Energy Fuels. 7 (2023) 2601–2612. https://doi.org/10.1039/D3SE00416C.
4. **Sandra Mathew,** Arun Varghese, Sunaja Devi K. R., Dephan Pinheiro, Architecture of a dual scheme MXene/$CoFe_2O_4$/g-C_3N_4 heterojunction for sustainable water remediation, Next Sustain. 4 (2024) 100049. https://doi.org/10.1016/j.nxsust.2024.100049.
5. **Sandra Mathew,** Sunaja Devi K.R., B. Saravanakumar, Dephan Pinheiro, Strategic design of MXene/$CoFe_2O_4$/g-C_3N_4 electrode for high-energy asymmetric supercapacitors, J. Alloys Compd. 1008 (2024) 176488. https://doi.org/10.1016/j.jallcom.2024.176488.
6. **Sandra Mathew,** Sunaja Devi K.R., Dephan Pinheiro, B. Saravanakumar, Advanced Electrochemical Performance of N-Ti_3C_2/MnO_2 MXene as a promising electrode for Energy Storage, Emergent Materials (2024). https://doi.org/10.1007/s42247-024-00928-2
7. **Sandra Mathew,** Madhushree Ramachandra, Sunaja Devi K R, Dephan Pinheiro, Sivakumar Manickam, C.H. Pang, S.H. Sonawane, Synthesis, mechanisms, challenges, and future prospects of Ti_3C_2 MXene and its heterojunctions for photocatalytic dye degradation efficiency: a comprehensive review, Mater. Today Sustain. 24 (2023) 100568. https://doi.org/10.1016/j.mtsust.2023.100568