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Notice for the PhD Viva Voce Examination

Ms Ann Mariella Babu, Registration Number: 2270126, PhD Scholar at the Department of Chemistry, School of Sciences, CHRIST (Deemed to be University) will defend her PhD thesis at the public viva-voce examination on Friday, 10 April 2026 at 02.00 pm in Room No. 044, Ground Floor, R&D Block, CHRIST (Deemed to be University), Bengaluru - 560029, Karnataka, India.

Title of the Thesis	:	**Utilization of CO_2 for the Production of Green Fuels: An Electrochemical Approach**
Discipline	:	**Chemistry**
External Examiner - I	:	**Dr Vishalakshi B** Professor Department of Chemistry Mangalore University Mangalagangotri – 574199 Karnataka
External Examiner - II	:	**Dr K V Gobi** Professor Department of Chemistry National Institute of Technology Warangal Hanamkonda Telangana - 506004
Supervisor	:	**Dr Anitha Varghese** 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 (Academics)

Place: Bengaluru
Date: 23 March 2026

ABSTRACT

Electrochemical reduction of carbon dioxide (CO2ER) has gained wide attention lately because of its potential to create a closed carbon loop, offering a sustainable solution towards environmental as well as energy crisis. Four unique electrocatalysts were rationally designed and developed to overcome the inherent limitations of CO2ER, with particular focus on selectivity and efficiency. In the first instance, an electrochemically prepared Cu coordinated metallopolymer was developed for the selective production of methanol. The hence-fabricated electrode described a well-integrated network like metal-polymer interface. Next, a Cu-coordinated aminothiazole based electrode (CAM) was developed. The hence-prepared CAM electrode displayed excellent efficiency towards the selective production of methanol and ethanol, marking significant achievement. Building upon the need for long-chain hydrocarbons, the next approach involved a bimetallic system. The electrochemically prepared catalyst displayed a prominent potential-dependent product shift from C1 to C2 products, which was beneficial in tuning the selectivity. Lastly, a multi-metallic nanocomposite was developed for electrochemical conversion of CO2 to multi-carbon oxygenates. Several physico-chemical investigations (SEM, TEM, IR, XRD, XPS, Optical profilometer, contact angle measurements) were conducted to understand the true nature of the electrode's behavior. The electrochemical characteristics were also analyzed for the electrodes using cyclic voltammetry, impedance and linear sweep voltammetry techniques. The liquid products after electrolysis were identified using proton NMR spectroscopy and quantified. Overall, the work described contributes to the fundamental understanding for developing an efficient CO2RR technology, with novelty in the fabrication of high-performance modified electrodes.

Keywords: *CO2 Utilization, Green fuel, Electrocatalyst, Carbon Dioxide Reduction, Copper*

Publications:

1. **Ann Mariella Babu**, Sobin Mathew, Anitha Varghese, Copper-Embedded Aminothiazole-Engineered Nanocatalyst for Electrochemical Reduction of CO2 to Alcohols, (2025), ACS Applied Nano Materials, 8, 36, 17630–17642.

2. **Ann Mariella Babu**, Sobin Mathew, Anitha Varghese; Silver Decorated Copper Coordination Polymer for the Electroreduction of CO2 to Hydrocarbon Liquid Fuels, (2025), Journal of Environmental Chemical Engineering, 116675.

3. **Ann Mariella Babu**, Anitha Varghese; Electroreduction of CO2 to Methanol Using a Coordination-Moiety-Anchored Carbon-Based Electrode, (2025), Langmuir.

4. **Ann Mariella Babu**, Mansi Gandhi, Khairunnisa Amreen, Anitha Varghese; Boosting Surface Coverage of CO Intermediates through Multimetallic Interface Interactions for Efficient CO2 Electrochemical Reduction, (2025), Langmuir, 41, 5, 3053–3065.