

Visiting Speaker

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TOPIC

Sustainable Synthesis Strategies of Metal-Organic Frameworks (MOFs) using Unconventional Precursors: Advances and Challenges

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 **10h00**

 Physics Department Computer LAN,
Main Science Building, Level 2,
University of KwaZulu-Natal, Pietermaritzburg

ABSTRACT: Metal-Organic Frameworks (MOFs) have emerged as a distinctive class of porous materials, prized for their exceptionally high surface areas, tunable porosity, and chemical versatility. These attributes position MOFs as promising candidates for diverse applications, including gas storage, catalysis, and environmental remediation. However, conventional MOF synthesis relies heavily on high-purity metal salts and fossil-derived organic linkers; resources that are costly, environmentally burdensome, and a major barrier to commercial scalability.

In response, recent research has begun to challenge this paradigm by exploring unconventional feedstocks. My talk will focus on the latest advances and persistent challenges in using alternative precursors such as metal-rich industrial waste materials, waste PET-derived organic linkers, biomass-derived linkers, among others. I will present a systematic classification of these precursors based on their chemical composition and synthetic suitability, and critically assess how these precursors influence MOF structure, porosity, and functional performance.

Furthermore, I will highlight our group's ongoing contributions to this field, with a particular emphasis on energy-related applications, including but not limited to clean energy storage and catalytic energy conversion. I will also briefly share our efforts in upscaling and induction of application-specific properties as we drive this technology towards real-world applications. By bridging sustainable Materials Chemistry with engineering aspects, this talk aims to outline an attractive pathway toward greener, more economically feasible MOF production.



PROFILE: NICHOLAS M. MUSYOKA

Nicholas Musyoka is an Associate Professor in Renewable Energy & Energy Storage at the University of Nottingham Ningbo China (UNNC). He obtained his PhD from the University of the Western Cape (South Africa). His research interests cut across innovations in Green Chemicals, Renewable Energy, and Energy Storage. Previously, Prof Musyoka led the Hydrogen South Africa Infrastructure and Carbon Capture and Utilization (HySA & CCU) research group at South Africa's Council for Scientific and Industrial Research (CSIR). He is currently a certified Senior Green Design Engineer by the World Green Design Organisation (WGDO) and listed as one of South Africa's National Research Foundation (NRF) C2 Rated Scientists. He has won several awards, such as the Innovings Excellent Innovation Award, Future Leaders–African Independent Research (FLAIR) Fellowship and IJHE David Sanborn Scott award. From his research activities, Prof Musyoka has authored over 107 peer-reviewed publications, 4 book chapters and holds 3 patents for innovative materials synthesis processes.

Additionally, he has presented invited talks at important high-level international events such as the G20 International Energy Transition Working Group Meetings, Pujiang Innovation Forum, Commonwealth Science Conferences, United Nations Industrial Development Organization (UNIDO) Day Conferences and also serves on the advisory boards of some Hydrogen-related organisations as well as a guest editor of some scientific journals.