UNIVERSITI MALAYA

Mini-Symposium

Towards Green Chemistry

20 NOVEMBER 2025

THURSDAY

10:00 am – 12:00 pm

ChM. Assoc. Prof. Dr. Tan Kar Ban

ChM. Dr. Khairil Anuar Jantan

ChM. Dr. Muntaz Abu Bakar

Anggerik room, level 3, Institute for Advanced Studies, Universiti Malaya

Jointly organised by

Division of Green & Sustainable Chemistry

NANOCAT
NANOTECHNOLOGY AND CATALYSIS RESEARCH CENTRE

Speaker: ChM. Assoc. Prof. Dr. Tan Kar Ban

Title: Optimising pyrochlore structured functional ceramics in the Bi_2O_3-MgO-M_2O_5 (M = Nb, Ta) Ternary Systems for ceramic capacitors

Abstract:
This presentation details the synthesis and characterisation of pyrochlores within the Bi_2O_3-MgO-M_2O_5 (M = Nb, Ta) ternary systems, focusing on their phase equilibria, crystallo-chemical and dielectric properties. Spectroscopic and microscopic techniques were employed to correlate the composition, structure and properties of these functional materials. Rigorous optimisation and processing were crucial for achieving single-phase pyrochlore synthesis, ensuring thermal equilibrium and preventing bismuth volatilisation. Phase diagrams for these ternary systems were constructed using comprehensive quantitative and qualitative XRD analyses, complemented by the disappearing phase method. The phase-pure pyrochlore subsolidus regions, phase compatibilities and phase assemblages between various phases were successfully determined. Furthermore, impedance data, superimposed on the pyrochlore subsolidus solution regions, illustrate the compositional influence on their dielectric properties. In summary, these highly insulating pyrochlores exhibit high dielectric constants and low dielectric losses, rendering them suitable for ceramic capacitor applications.

Biography:
Dr. Kar Ban Tan holds an associate professorship in the Department of Chemistry, Faculty of Science, Universiti Putra Malaysia. His research focuses on the synthesis and characterisation of functional electroceramics, employing diverse spectroscopic and microscopic techniques. Dr. Tan has led numerous research projects funded by both public and private sources, resulting in over 200 publications encompassing scientific papers, conference proceedings, book chapters and patents. His innovative work has garnered significant recognition through various awards and competitions. Furthermore, he serves on the editorial boards and as a reviewer for many internationally renowned journals. Dr. Tan has actively participated in many professional service activities, including conferences, workshops, mobility and outreach programs, course accreditation and student development initiatives. He is a Fellow of the Royal Society of Chemistry (U.K.) and a member of several professional organisations, including the Malaysian Institute of Chemistry, the American Chemical Society and the Young Scientist Network.

Speaker: ChM. Dr. Khairil Anuar Jantan

Title: Closing the Loop: From Automotive Waste to Tailored Palladium Catalysts

Abstract:
The critical reliance on palladium in catalysis is challenged by its scarcity, cost, and the environmental impact of mining. We present a circular solution that sources high-performance palladium catalysts directly from end-of-life automotive catalytic converters (TWCs). Our approach begins with selective, acid-free leaching of palladium from model TWCs using halogen-donor ligands (e.g., $Me_2dazdt{\cdot}2I_2$, $[N^+Bu_4]I/I_2$). Crucially, we bypass energy-intensive metal reduction, instead using the complexes obtained directly in the catalysis process. Complexes like $[Pd(Me_2dazdt)_2]I6$ and $[PdI_2(Me_2dazdt)]$ prove highly effective for oxidative C–H functionalization, outperforming conventional $Pd(OAc)_2$ with quantitative yields under milder conditions (50 °C, 1-3 mol% Pd, 1-3 h). To expand utility, a ligand-exchange strategy on the primary product $[N^+Bu_4]_2[Pd_2I_6]$ yielded phosphine analogues like $PdI_2(dppf)$, a sustainable substitute for $PdCl_2(dppf)$. This catalyst enabled efficient Buchwald-Hartwig amination (1-2 mol% Pd) in the green solvent CPME, optimized via Design of Experiments (DoE). We further enhanced sustainability through recycling. A palladium complex was immobilized on magnetic nanoparticles for facile recovery, and a closed-loop process was demonstrated, where spent catalyst (Pd black) was regenerated into active $[N^+Bu_4]_2[Pd_2I_6]$ and reused without loss of activity. This work establishes a viable pathway to decouple palladium catalysis from primary mining. By valorizing waste through direct application, we create high-performance catalytic systems that align with the principles of green chemistry and the circular economy.

Biography:
Dr. Khairil Anuar Jantan is a Senior Lecturer in the School of Chemistry and Environment at the Faculty of Applied Sciences, Universiti Teknologi MARA (UiTM). He earned his PhD in Chemistry from Imperial College London in 2019. His academic foundation includes an MSc in Chemistry from Universiti Kebangsaan Malaysia (UKM) and a BSc (Hons) in Applied Chemistry from UiTM. Dr. Khairil further honed his research expertise through a two-year postdoctoral fellowship at Imperial College London, where he specialized in the field of Sustainable Catalysis. With an academic career spanning over 16 years, he has extensive experience in teaching chemistry. He is also a professional member of the Malaysian Institute of Chemistry and the Royal Society of Chemistry.

Speaker: ChM. Dr. Muntaz Abu Bakar

Title: Advances in Porphyrin Synthesis and Applications: From Functionalized Macrocycles to Biomedical and Environmental Prospects

Abstract:
Porphyrins are versatile macrocyclic compounds with tunable photophysical and redox properties, enabling diverse applications across biomedicine and environmental science. Recent advances in synthesis, including organolithium substitution and palladium-catalyzed cross-coupling reactions (Suzuki, Sonogashira, Heck), have yielded both symmetrical and asymmetrical porphyrins, while metallation with transition metals such as Zn(II) and Ni(II) affords stable complexes with high efficiencies. These structural modifications underpin significant biomedical potential, notably as photosensitizers in photodynamic therapy and as modulators of apoptosis-related proteins such as Bcl-2, suggesting applications in anticancer strategies. Moreover, metalloporphyrins demonstrate potent antimalarial activity through inhibition of hemozoin crystallization in Plasmodium falciparum, either independently or synergistically with established drugs. Beyond therapeutic uses, functionalized A_2-type porphyrins and their metallated analogues enhance CO_2 capture through heterogeneous binding and multilayer interactions, offering promising avenues for integration into MOF and COF architectures. Collectively, these developments highlight the central role of synthetic tailoring in expanding porphyrin functionality, bridging cutting-edge biomedical innovation with sustainable environmental technologies.

Biography:
Dr Muntaz is a Senior Lecturer at the Faculty of Science and Technology, Universiti Kebangsaan Malaysia (UKM). She received her Bachelor's degree in Industrial Chemistry from Universiti Teknologi Malaysia (UTM, Skudai), her Master's degree in Natural Products Chemistry from Universiti Kebangsaan Malaysia (Bangi), and her PhD in Organic Chemistry from Trinity College Dublin (TCD), Ireland, where she specialized in the synthesis of porphyrin derivatives. Her research expertise spans natural product chemistry, organic synthesis, and functional materials, with porphyrins serving as a central theme in her scientific work. She has explored synthetic modifications of porphyrins for applications in catalysis, sensors, and therapeutic studies, contributing to the advancement of organic functional materials. In addition, her work has bridged the fields of natural product chemistry and porphyrin-based molecular design, with a growing focus on translational potential in health and environmental technologies. Beyond research, Dr. Muntaz is committed to mentoring and capacity building. She has actively led school-based mentor–mentee programs, where her guidance has enabled students to achieve numerous awards at both national and international competitions, reflecting her dedication to nurturing the next generation of scientists. She also serves as the Chief Financial Officer (CFO) of Chemsci, a UKM spin-off company, where she plays a pivotal role in translating academic innovations into entrepreneurial ventures. This dual academic–industrial engagement highlights her commitment to advancing research with real-world applications while strengthening the university's innovation ecosystem.