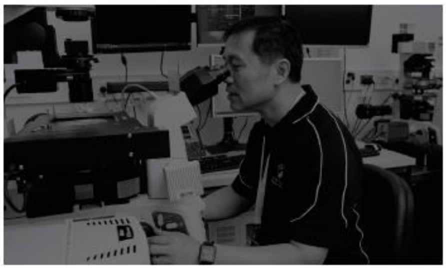

Recent Advances in X-ray Imaging Scintillators

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11:00am, 15/02/2024
Melbourne Centre for Nanofabrication
151 Wellington Road, Clayton, 3168
Zoom link: click here
Meeting ID: 863 7672 2911 and passcode: 973029

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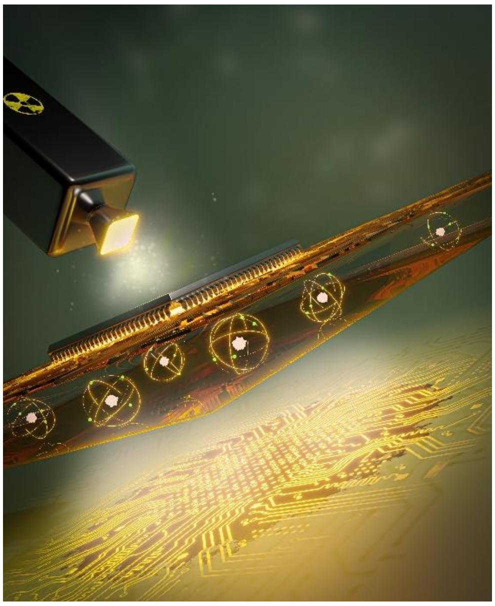
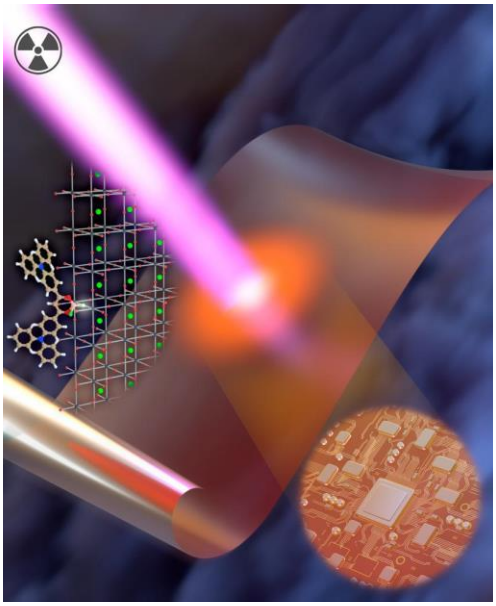
Abstract:
The high demand for ultralow detection limits of ionizing radiation in medical radiography, high-energy physics, and security screening has driven extensive research on X-ray imaging scintillators.1-4 While high-performance scintillators in the current X-ray imaging market made of ceramics that require harsh and costly preparation and engineering conditions, perovskites and their related structures, heavy-atom engineered thermally activated delayed fluorescence (TADF) and copper nanoclusters with their unique optical behaviors and high X-ray absorption cross section are now promising competitors if not alternatives. In this talk, I will present the engineering of perovskite nanosheets with excellent scintillation performance due to efficient energy transfer processes between stacked thin and thick nanosheet.5 Additionally, I will talk about the efficient and ultrafast energy transfer strategies between perovskite nanosheets and TADF that successfully produced a reabsorption-free organic X-ray imaging scintillator with an ultralow detection limits and outstanding X-ray imaging resolution.6 Similarly, I will talk about perovskite related Cu and Ag halides as well as Cu-based halide nanostructures that showed outstanding X-ray imaging performance.7 Moreover, we will discuss the fabrication of a thick pixelated needle-like array scintillator capable of micrometer resolution via waveguide structure engineering that lead to ultra-high spatial resolutions of 60.8 lp mm-1, representing a laboratory-scale record for extensively studied metal halide scintillators. The talk also discusses a novel top-filter-bottom sandwich structure scintillator for high-performance dual-energy X-ray imaging within a single exposure.8 Finally, our innovation of true-color multi-energy X-ray imaging technology centered around multiple scintillator architecture with a six-layer ΔE-E telescope configuration to achieve powerful material-specific capability, surpassing what is offered by traditional X-ray imaging technologies will also be discussed in this talk. This breakthrough research enables clear resolution of different biological tissues and materials objects based on their corresponding colors and paves the way for the development of new imaging scintillator architectures with potential applications in medical imaging, industrial monitoring and security checks.





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Dr. Omar Mohammed is Professor of Chemistry and Materials Science & Engineering; and the principal investigator of ultrafast laser spectroscopy and four-dimensional (4D) electron imaging laboratory at KAUST. He earned a Ph.D in Physical and Theoretical Chemistry from Humboldt University of Berlin, Germany. Prior to joining KAUST, Dr. Mohammed was a senior research associate at Caltech, where he worked with Professor Zewail, a Nobel laureate, on developing innovative laser spectroscopic and time-resolved electron imaging techniques. During his time at Caltech, Dr. Mohammed made significant contributions to the profound understanding of the dynamics of photo-generated charge carriers in photoactive materials, and pioneered the development of advanced characterization techniques for studying surface and interfacial dynamics on nanometer and femtosecond scales. The current research activities of Dr. Mohammed are focused on the development of highly efficient solar cells, light-emitting diodes and X-ray imaging scintillators with the aid of ultrafast laser spectroscopy, 4D electron imaging and computational materials.

Dr. Mohammed has published over 320 articles in international peer-reviewed journals including Science, Nature, Nature Materials, Nature Energy and Nature Photonics, large number of these papers are currently highly cited (□ 39 papers). Dr. Mohammed has more than 35,000 citations and 84 h-index. In 2019, 2020, 2021, 2022 and 2023, Dr. Mohammed was identified as a Highly Cited Researcher by Web of Science. In January 2020, he joined the Editorial Advisory Board of the Journal of Physical Chemistry Letters. In February, 2021, he was named a Fellow of the Royal Society of Chemistry (FRSC). In March, 1, 2021, Dr. Mohammed was appointed an Associate Editor of ACS Applied Materials & Interfaces. In January 2023, he joined the Editorial Advisory Board of ACS Materials Letters and the Journal of Physical Chemistry A & B & C (American Chemical Society) – some of the leading journals of the field of Physical Chemistry and Materials Science. In July 2023, he was named a Fellow of the Institute of Physics (IOP). Finally, Dr. Mohammed is the recipient of several prestigious awards, including the Distinguished Scholar Award from Arab Fund for Economic and Social Development, Kuwait; Long-term Fellowship, Germany, the Japan Society for the Promotion of Science (JSPS) fellowship, Japan, the State Prize in Basic Sciences, Egypt, Shoman Prize in Photochemistry, Shoman Foundation, Jordan, and Kuwait Prize in Physics, Kuwait Foundation, Kuwait.