Biography:

Jonathan E. Halpert is an assistant professor in the Department of Chemistry (CHEM), in the School of Science (SSCI) at The Hong Kong University of Science and Technology (HKUST). He received his Ph.D. in Physical Chemistry in 2008 at the Massachusetts Institute of Technology (MIT) and later was a visiting fellow at the Chinese Academy of Sciences' Institute for Process Engineering (CAS-IPE), and a postdoctoral researcher in the Optoelectronics Group (OE) at the University of Cambridge. He started his group as a lecturer and senior lecturer in the School of Chemical and Physical Sciences (SCPS) at the Victoria University of Wellington (VUW) from 2013-2017, where he was a Rutherford Discovery Fellow and a Principal Investigator in the MacDiarmid Institute for Advanced Materials and Nanotechnology. The Halpert Group has recently moved to HKUST in 2017 where their research interests include nanocrystals, nanomaterials and quantum dots using semiconductor materials, especially perovskites, to produce functional electronic and optoelectronic devices, including memristors, energy storage devices, photodetectors, solar cells and LEDs. Prof. Halpert is an author on >50 peer-reviewed papers, with more than 7500 career citations (GS), and 11 US patents and applications. His work has been published in such esteemed journals as the Journal of the American Chemical Society, ACS Nano, Nano Letters, Nature Photonics, Nature Communications, Energy & Environmental Science, Chemistry of Materials, the Journal of Physical Chemistry Letters, ACS Photonics, and ACS Applied Materials & Interfaces, among others. The Halpert Group is currently focused on lead-free metal-metal halide materials and devices.

Title: Advances in Perovskite Chemistry and Nanomaterials for Optoelectronic Applications

Abstract:

Metal halide perovskites possess excellent properties for solar cells and light emitting devices (LEDs), having very bright emission, high photoluminescence quantum yield, a thin emission linewidth and a composition and size tunable color range across the visible spectrum. Already solar cells with high PCE >21 % using methylammonium lead iodide in n-i-p style devices have been reported in what has become a massive field of study. However, many niche devices such as all-solution processed, high Voc, semi-transparent, p-i-n and quantum dot-based perovskite solar cells are less well developed. Similarly, perovskite LEDs with >20% EQE have been reported for red and green emitting LEDs, but blue emitting devices have lagged behind and must be improved in both efficiency and lifetime. To improve the stability and emission of LEDs, lead-free and other novel perovskite (or "perovskite-inspired") materials are being developed that could point towards the future of the perovskite field. Here we will outline our recent improvements in nanomaterials engineering and chemical synthesis to improve the performance of perovskite based optoelectronic devices, in particular LEDs and solar cells. We will also discuss some of the novel materials designed in our group and suggest some of the future applications for this fascinating class of materials.