Missouri S&T Chemistry Seminar

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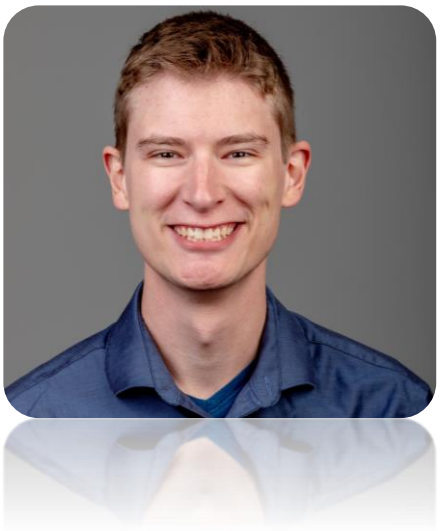

Monday, 7 April, 2025

4:00 pm in 126 Schrenk Hall

Photoluminescence Spectroscopy of Epitaxially Electrodeposited Cuprous Iodide vs Traditionally Produced Films

Abstract: Cuprous iodide (CuI) is a wide bandgap (3.1 eV) p-type semiconductor with high hole mobility and excellent optical transparency, making it a promising material for optoelectronic applications such as solar cells, photodetectors, and light-emitting diodes. Despite its favorable properties, traditional thermally grown CuI films have exhibited limited electrical performance due to defect-related nonradiative recombination. Electrodeposition has emerged as a promising alternative to thermal growth, enabling the production of highly ordered CuI thin films with improved stoichiometry and reduced defect density. In this work, the photoluminescence (PL) emission of CuI thin films produced by electrodeposition was compared with that of films produced by traditional thermal growth methods. By analyzing the relative intensity of free and bound exciton emissions, the defect landscape and crystal quality of each type of film were assessed. Electrodeposited films were found to exhibit purer free exciton emission, indicative of lower defect density and more favorable optoelectronic properties. Furthermore, an inverse relationship between film coverage and PL intensity was observed, suggesting that an increased number of grain boundaries in more densely covered films introduced additional nonradiative recombination pathways

Additionally, with specific relevance to the Missouri S&T Chemistry Department, experimental considerations for thin-film photoluminescence spectroscopy using the Shared Instrument Lab's FS5 Spectrofluorometer are addressed. CuI's optical transparency, combined with the reflective nature of certain substrates, was found to produce spurious peaks in PL spectra due to white light scattering from the allegedly monochromatic source. The nature and origin of these spurious peaks are discussed, and a straightforward strategy to eliminate them is presented.