TCSUH Bi-Weekly Seminar

Advancing Human-Centric Lighting with Phosphor Converted Violet LEDs

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In Person – Room 102, Houston Science Center, 12:00 p.m. – 1:00 p.m.

Sandwiches will be provided on a first-come, first-served basis.

ABSTRACT: The concept of human-centric lighting stems from the evolution of sunlight's intensity and color temperature throughout the course of a day. This natural progression of bright cold-white light during the middle of the day to a softer warm-white light in the evening stimulates intrinsic photosensitive retinal ganglion cells that control our circadian rhythm. The blue-hue of daylight activates these cells to produce dopamine and cortisol while suppressing melatonin, the sleep hormone, to keep humans awake and alert. The current generation of energy-efficient LED lights reproduces daylight by converting a blue-emitting LED into a broad-spectrum white light using inorganic phosphors. Unfortunately, the resulting intense blue-hue generated by cheap LED bulbs and the underlying blue light from even the most expensive bulbs have been shown to cause macular degeneration, cataract formation, mood disorders, and circadian disruption, resulting in insomnia and fatigue. This talk will investigate alternative solutions to reduce the amount of blue light generated by modern LED lights. The core change will require identifying new luminescent phosphors that pair with violet-emitting LED chips while still producing high-quality white light. As a result, we have been developing materials like blue-emitting $Na_2MgPO_4F:Eu^{2+}$ and $K_3AlP_3O_9N:Eu^{2+}$, and the green-emitting $NaBaB_9O_{15}:Eu^{2+}$ that meet all of the necessary requirements, including a high quantum yield, thermally robust emission, and strong violet absorption. Incorporating these materials into prototype devices demonstrates that it is possible to produce a warm-white light with a higher color rendering index than a commercially purchased LED light bulb while significantly reducing the blue component.

BIO: Prof. Jakoah Brgoch is an Associate Professor in the Department of Chemistry and a Principal Investigator in the Texas Center of Superconductivity. Jakoah also has a courtesy appointment in the William A. Brookshire Department of Chemical and Biomolecular Engineering and he is a member of the Hewlett-Packard Enterprise Data Science Institute. Jakoah completed his bachelors and masters in Chemistry from Illinois State University followed by his Ph.D. from Iowa State University and Ames National Laboratory under the supervision of Gordon Miller followed by postdoctoral research at the University of California, Santa Barbara in the Materials Research Laboratory with Ram Seshadri. Jakoah is now leading a multidisciplinary research group with research topics ranging from the development of persistent luminescent materials for bio-imaging to understanding the mechanical response in superhard materials all through a combination of materials synthesis, characterization, first-principles computation, and machine learning. He has published more than 85 peer-reviewed papers, earned a 2018 NSF CAREER research award, and is a 2020 Alfred P. Sloan Research Fellow in Chemistry.

Persons with disabilities who require special accommodations to attend this lecture should call (713) 743-8212.