University at Buffalo
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OPTICAL PROPERTIES & APPLICATIONS OF NEW COPPER(I) HALIDES

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Abstract: The emergence of lead halide perovskites for optical and electronic applications has been one of the most important discoveries of the past two decades in the field of materials chemistry. To accelerate the practical use of metal halide perovskites, there is a global search for alternative non-toxic lead-free halides that demonstrate higher environmental stability while preserving the advantageous properties of lead halides such as their outstanding optical properties. In this talk, our recent discoveries of brand-new families of lead-free high efficiency light-emitting materials will be summarized. These include all-inorganic copper(I) halides that demonstrate low-dimensional non-perovskite crystal structures, and consequently, very flat bands around the band gap, leading to very localized charges. Such charge localization and low-dimensional structures typically result in the presence of high stability self-trapped excitons at room temperature yielding record high photoluminescence quantum efficiency light emission properties. Our findings on all-inorganic copper halides will be compared to the light emission properties of low-dimensional hybrid organic-inorganic halides. The talk will conclude with a few examples of the potential practical applications of the luminescent metal halides mentioned in this presentation.

Bio: Dr Bayram Saparov is an Associate Professor of Chemistry at the University of Oklahoma. Dr. Saparov received his undergraduate Diploma from Lomonosov Moscow State University in Russia in 2006. Then, he attended the University of Delaware to get his PhD in Inorganic Solid-State Chemistry. His PhD research was focused on the preparation and structural studies of Zintl pnictides. After graduating in 2011, he worked as a postdoc at Oak Ridge National Laboratory focusing on iron-based superconductors and permanent magnets. He continued his postdoctoral training with Dr. David Mitzi at Duke University as a DOE SunShot Postdoctoral fellow from 2014 to 2016. During this time, he synthesized and characterized new halide and chalcogenide semiconductors for solar cell applications.

Dr. Saparov has 15 years working experience in the fields of solid-state and materials chemistry, which has resulted in over 80 published research and review articles in reputable journals and book chapters. His current research interests include preparation of halide-based phosphor materials, development of materials for space solar applications and semiconducting and magnetic properties of new chalcogenide materials. He is a recipient of several awards recognizing his scholarly work including the 2017 Ralph E. Powe Junior Faculty Enhancement Award from Oak Ridge Associated Universities (ORAU), and DOE Early Career Award (2020) and NSF CAREER Award (2021).

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