J. Clarence Karcher Lecture

◆DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY ◆THE UNIVERSITY OF OKLAHOMA
◆NORMAN, OK 73019-5251◆ (405) 325-4811◆

We Are Pleased to Announce a Seminar
Presented By

David Mitzi
Duke University
Department of Mechanical Engineering and Materials Science
Department of Chemistry

Friday, October 28, 2022
4:15 pm
National Weather Center
Room 1313

Hybrid Halide Perovskites: Highly Diverse and Tunable Semiconductors

Although known for many years, organic-inorganic ("hybrid") perovskites have received extraordinary attention recently, because of the unique physical properties and chemical diversity offered by these structures, which make them outstanding candidates for applications in photovoltaic and other semiconductor devices. Hybrid perovskite crystal structures consist of networks of corner-sharing metal halide octahedra that extend in three or lower dimensions, interspersed with organic cations. The current presentation will introduce these systems and explore several examples of the remarkable flexibility afforded by this unique semiconductor family (enabled in part by the mixing of organic/inorganic functionalities). Examples may include chiral transfer within the structure, mediated by hydrogen bonding and fine-tuned through kinetically modulated structural transitions, which allows for control over crystal symmetry and associated properties (e.g., spin splitting, ferroelectricity, non-linear optics). Alternatively, choice of organic cation strongly influences the melting temperature of the perovskites by >100°C, enabling facile film melt-processing and the design of hybrid phase-change materials exhibiting glass-crystalline switching and associated modulation in optoelectronic properties. A third prospective topic involves semiconductor doping (effective control over carrier density/type), which underlies most successful semiconductor device design and optimization. While generally challenging in halide perovskites, a recent study shows the use of the molecular dopant F4TCNQ as one pathway for effective control of carrier density in 3D perovskites. The above recent examples of tunability point to new opportunities for fundamental science and prospective applications for these materials.

Refreshments will be served at 4:00 pm

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