Organometallic Molecular Design Strategies for Luminescence, Sensing, and Photoredox Catalysis

This talk describes complementary synthetic strategies to enhance the photoluminescence and photoredox properties of organometallic complexes. We have addressed the long-standing challenge of designing efficient and stable blue-phosphorescent molecules, currently the most significant technological hurdle in OLED technology. Our efforts have resulted in new designs for blue-emitting iridium complexes, using strongly σ-donating acyclic diaminocarbene supporting ligands installed by unconventional routes relying on the electrophilic reactivity of coordinated isocyanides. Using a different design, we have employed nitrogen-containing, π-donating ancillary ligands in the development of new bis-cyclometalated iridium complexes which are efficient red and near-infrared phosphors or potent photoreductants for applications in photoredox catalysis. And finally, a more recent effort in our group has produced a modular synthetic strategy to prepare multi-chromophore arrays featuring cyclometalated iridium, providing easy access to new classes of luminescent supramolecular constructs. In addition to providing rich platforms for studying fundamental aspects of excited-state dynamics, some of these compounds function as ratiometric oxygen sensors in hypoxic environments.