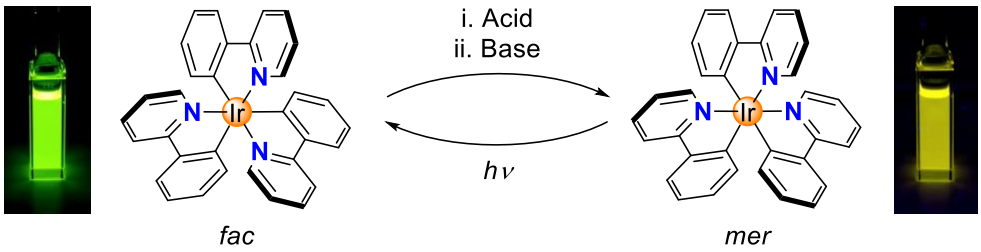
Reversible switching of luminescence of Ir(III) complexes

Anastasia Gitlina, Kay Severin

Institut des Sciences et Ingénierie Chimiques, Ecole Polytechnique Fédérale de Lausanne (EPFL)
Av. F.-A. Forel 2, 1015 Lausanne, Switzerland
E-mail: anastasia.gitlina@epfl.ch

Chromism is a reversible change of color induced by external stimuli (e.g. light, heat, chemical reaction). Chromic compounds provide a solid basis for smart materials that are the most commonly applied nowadays in high-technology, such as electronics, optics, thermometry, biomedicine, textile fabrication etc.[1] Recently, chromic metal complexes are of growing interest because of their diverse structures and functions. Recent achievements have been reached in the metal complexes featured by well-known photochromic switches like azobenzenes, merocyanines, diarylethenes.[2] However, the chromic metal complexes based on their intrinsic stimuli-induced behavior, which could open a new field of switches, are rare because of limited methodologies of designing of such compounds.

Hereby we introduce a new class of chromic molecular switches based on luminescent arylpyridyl Ir(III) complexes widely known due to their unique chemical and photophysical properties.[3] Luminescence chromism of the complexes is achieved by a reversible switching between two geometric isomers (*fac* and *mer*) having distinct emission properties (Scheme 1).



Scheme 1. Switching between *fac*-Ir(ppy)$_3$ and *mer*-Ir(ppy)$_3$.

The switching procedure combines a well-studied photo-induced *mer*→*fac* isomerization[4] and a novel acid-base-induced *fac*→*mer* isomerization developed first in our group. The chemically induced isomerization is fast, clean, quantitative, tolerant to different substituents, and stereoselective. It also opens up a new synthetic possibility to access the *mer* isomers, which are difficult to prepare otherwise.

The luminescence chromism of Ir(III) switches was found reversible for at least ten cycles. As a proof-of-concept, a luminescent display was prepared as a demonstration of possibility to use this complexes for such type of smart materials as rewritable data storage devices.

The authors greatly appreciate a financial support from Swiss National Science Foundation (SNSF) and EPFL as well as facility/equipment available within EPFL.

[1] W. Chen, Y. Pan, J. Chen., *Chin. Chem. Let.*, **2018**, *29*, 1429-1435.
[2] C.-C. Ko, V. Wing-Wah Yam, *J. Mater. Chem.*, **2010**, *20*, 2063-2070.
[3] E. Zysman-Colman, Iridium(III) in Optoelectronic and Photonics Application, *John Wiley & Sons*, Chichester, West Sussex, **2017**.
[4] A. McDonald, M. Lutz, L. von Chrzanowski, *Inorg. Chem.*, **2008**, *47*, 6681-6691.