

# TRANSITION METAL CLUSTER COMPOUNDS: LUMINESCENCE AND DESIGN OF (NANO)COMPOSITES

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Miniature photonic integrated devices, in optoelectronic, biomedical or catalytic applications, involve the development of new light micro- or nano-sources. The precise design of such emitting structures is a challenging subject for controlling spectral and temporal characteristics and understanding mechanisms of emission and of interaction between emitters. Moreover, one-dimensional nanostructures promote enhanced properties and new paradigms for photonic devices, including intriguing waveguiding behaviour. The current presentation will give an overview of main results obtained in this context by our consortium the last three years.

We have investigated  $[M_6Q_8L^a_6]^{n-}$  octahedral transition metal clusters compounds as original emitter. Indeed these compounds possess remarkable optical properties: high photostability, broad excitation (UV-vis) and emission bands (vis-NIR) and large Stokes shift, especially for molybdenum cluster units. Metal clusters compounds have been successfully integrated in micrometric SU8 polymeric waveguides, a reference photoresist for organic photonics. Optical characterizations of these new composites have shown interesting properties, as a significant increase of the refractive index and an efficient photoluminescence propagation.[1] Further, subwavelength waveguides –nanowires and nanotubes– have also been designed by hard-template method. One such nanostructure has been realized with two kinds of luminophores in a coaxial geometry: a green polymeric emitter shell (polyparaphenylene-vinylene, PPV) and a red phosphorescent emitter core ( $[Mo_6Br_8F^a_6]^{2-}$  clusters@PMMA), the spatial separation avoiding charge/energy transfers and leading to a facile color control.[2]

1- N. Huby, et al., Optical Materials, 52, 196 (2016)

2- A. Garreau et al., ACS Nano, 7, 2977 (2013)