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Review

Development of photoluminescence metal-organic framework sensors consisting of dual-emission centers

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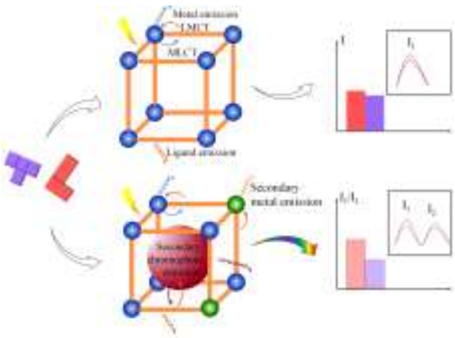
Graphical abstract



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ABSTRACT

Incorporation of luminescent moieties into metal-organic frameworks (MOFs) has resulted in numerous photoluminescence (PL) sensors based on chromophore-analyte interactions. However, most of them are only highly sensitive to few analytes limited by the single luminescent centers in MOFs. To improve the application scopes, dual-emission MOFs were therefore emerged, which can significantly improve the sensitivity by monitoring the relative emission intensity of two luminescent centers. This short review will highlight the recent progress on dual-emission MOFs as highly sensitive sensors for probing of volatile organic molecules (VOMs), picric acid and peroxynitrite, and as self-calibration PL thermometer.

1. Introduction

Metal-organic frameworks (MOFs) are an emerging class of porous hybrid materials, building from metal ions/clusters and polydentate organic ligands connected by coordination bonds [1-3]. Attracted by the high porosity and the tunable framework structures and functionalities, MOFs have been extensively studied in past two decades, and realized applications in many fields, such as gas storage and separation [4-6], heterogeneous catalysis [7-9], drug delivery [10], and chemical sensing [11].

Incorporation of luminescent moieties into porous MOFs has generated many unique luminescent materials. Because the photoluminescence (PL) of MOFs is responsive to the encapsulated guest molecules, MOFs have been realized applications in environmental sensing and biology imaging [12-14]. Compared with traditional materials, MOFs exhibit the following features: (1) The PL properties are systematically tunable by simply adjusting the constituent luminescent moieties, such as metal nodes, organic ligands and encapsulated molecules inside the pores; (2) The pore sizes, shapes, functionality, and hydrophobic and hydrophilic pore nature can be deliberately designed and modified to improve the recognition ability; (3) Tiny differences of the interactions between PL moieties and encapsulated guests would significantly affect the emissions.

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