Selective Luminescence Switching in Entangled Metal-Organic Frameworks by Inclusion of Aromatic Guests. Molecular Sensor for Substituted-Benzenes.

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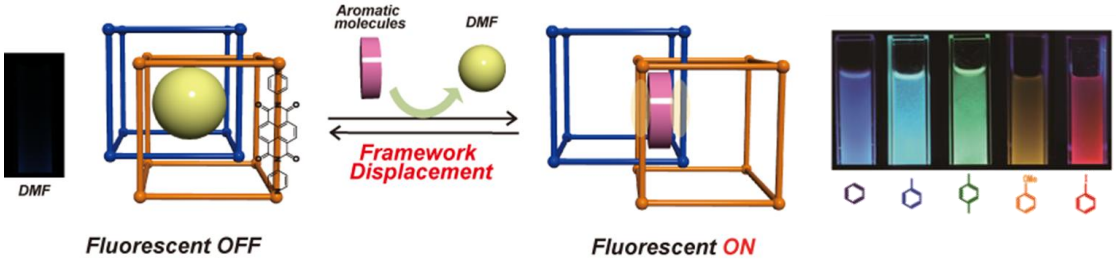
Porous coordination polymers (PCPs) or metal–organic framework (MOFs) are recently considered as a functional class of porous materials. The designability by varying the nature of the coordination metals and the organic linkers, the cristallinity in their structures resulting in nanometer-size confined spaces and the flexibility by the entanglement of their frameworks are unique properties for the development of multiple applications such as gas storage and gas separation, heterogeneous catalysts and molecular sensors.

The design of a PCP with photoactive entities as part of the structure and whose luminescent properties are highly sensitive to guests can offer potential application as luminescent sensors.

In this work [1], a new interpenetrated porous coordination polymer with naphthalenediimide (NDI) incorporated as fluorophore linker exhibits an unpredicted turn-on emission upon the incorporation of a class of aromatic compounds (substituted-benzenes). The unexpected luminescent properties are as consequence of the induced-fit structural transformation (framework displacement), checked by single-crystal x-ray diffraction, triggered by the guests incorporation to maximize the interaction with NDI. Non-interpenetrated analog. PCP (frameworks are impossible to slide) shows no luminescence, indicating the importance of the dynamic confined space for the luminescence.

The entangled PCP exhibits different luminescent colour depending on the substitution of the benzene ring as guests. For instance, from strong electron withdrawing (cyano) to electron donating capacity of the substituents (methoxy), the fluorescence can be tuned in the whole visible region (from 400 to 700 nm) or even stabilized radical-ion species (N,N-dimethyl). On the other hand, when halogen atoms are included in the benzene ring, a switching from fluorescence to phosphorescence emission is observed.

In this way, this new PCP can be used as a molecular sensor for benzene derivates which can recognized tiny differences in the substitution of aromatic ring and converted into a detectable signal (even by eye).



References

[1] Y. Takashima, V. Martínez-Martínez, S. Furukawa, M. Kondo, S. Shimomura, H. Uehara, M. Nakahama, K. Sugimoto and S. Kitagawa. **Nature Communications** (accepted).