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Light-Responsive Porous Aromatic Frameworks: Generation of Photon Upconverted Emission and Modulation of Porosity by Bulk Photoisomerization †

Jacopo Perego [1,*], Silvia Bracco [1], Charl X. Bezuidenhout [1], Angiolina Comotti [1], Piero Sozzani [1]

[1] Department of Materials Science, University of Milano Bicocca, Milan, Italy
* Correspondence: jacopo.perego@unimib.it;
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Abstract: Porous aromatic frameworks (PAFs) were engineered to generate solid-state upconverting materials that emit higher energy photons under a suitable light stimulus [1]. Fluorescent PAFs were generated by the inclusion of diphenylanthracene moieties in a low-density 3D porous frameworks that maintained the optical properties of the emitting chromophores in the solid-state. Upon inclusion of a suitable sensitizer (a metallo-porphyrin) inside the nanometer-sized pores, the copolymer displayed sensitized photon upconversion with a quantum yield as high as 15%, a record value for solid-state materials. Moreover, it was possible to tether the sensitizer to the porous matrix through a stable covalent bond, generating self-standing upconverting nanoparticles that can be possibly applied in photovoltaics and bio-imaging.
PAFs can also be engineered as light-responsive materials. The co-polymerization of a photoswitch with tetraphenylmethane generated porous networks that provided the free volume for the photoisomerization of the overcrowded alkene [2]. Under UV light irradiation, the quantitative photoisomerization led to structural changes and modulated the CO_2 adsorptive properties of the material. The process is reversible by irradiation or heating leading to a cyclable material.

Keywords: porous aromatic frameworks; photon upconversion; fluorescent nanoparticles; photoisomerization, molecular motors.

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Conflicts of Interest

The authors declare no conflict of interest.