Optical property changes of porphyrin MOFs by interacting with surface plasmon resonance of anisotropic silver nanoparticles

(*Collagel of Science and Technology, Nihon University*) ○Koki Honma, Kosuke Sugawa, Joe Otsuki

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Metal organic frameworks (MOFs), which are composed of organic linkers and metal nodes, are applicable to molecular storage, catalysis, and so on. In addition, MOFs have been reported to have an efficient light harvesting property by combining with photo functional linkers.[1)] Therefore, optical interaction between strong electromagnetic fields associated with localized surface plasmon resonance (LSPR) and the photofunctional MOFs can be quite interesting. In this study, we developed hybridized thin films (AgPRs/PP-MOFs) composed of triangular Ag nanoprisms (AgPRs) and porphyrin-based MOFs (PP-MOFs) and investigated their emissive properties. The PP-MOFs used was composed of tetrakis (4-carboxyphenyl) porphyrin (TCPP) and Zn(II) ions.[2)] While the extinction spectrum of reference (PP-MOFs without any AgPRs) showed a Soret band at 430 nm, the spectrum in which the LSPR band (in-plane dipole mode) of AgPRs at 545 nm is added to the Soret band is shown for AgPRs/PP-MOFs (Fig. 1(a)). For the emission spectra (Fig. 1(b), λ_{ex} = 430 nm), the emission attributed to the Zn-TCPP in PP-MOF of AgPRs/PP-MOFs was significantly (4.5 times) higher than that from the reference sample. Since the LSPR wavelengths overlapped with the emission band of Zn-TCPP, the enhancement could be attributed to the optical interaction between the photoexcited PP-MOFs and the strong electromagnetic fields of LSPR.

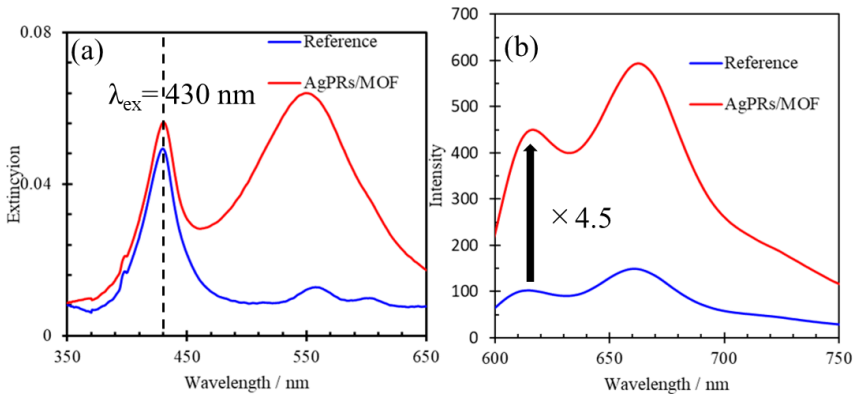

Fig. 1 (a) Extinction spectra and (b) emission spectra (λ_{ex} = 430 nm) of AgPRs/PP-MOFs and reference (PP-MOFs without any AgPRs).

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1) H.-J. Son et al., *J. Am. Chem. Soc,* **2013**, *135*, 862. 2) Z. Zhou et al., *J. Mater. Chem. A,* **2020**, *8*, 25941.