Synthesis of porphyrin comprising nanodisks from covalent organic frameworks through mechanical stirring and investigation of their photocatalytic activity

([1]*The Institute of Scientific and Industrial Research, Osaka University*) ○Xinxi Li,[1] Yasuko Osakada, [1] Mamoru Fujitsuka[1]

Keywords: Porphyrin; Covalent Organic Frameworks; Two-Dimensional Polymer; Photocatalysis; Nanomaterials

Two-dimensional (2D) materials such as graphene are attractive for applications in materials science, biology, energy storage, and photocatalysis. One of the simplest methods to synthesize 2D materials such as nanodisks from layered materials is liquid-phase exfoliation. In liquid phase exfoliation for the synthesis of 2D polymers, covalent organic frameworks (COFs) are commonly used as an exfoliating material because of their layered structure. In the previous studies, COFs with benzene or triphenylbenzene as core units were exfoliated by immersion or mechanical sonication in common solvents.[1] However, exfoliation of COFs containing porphyrin-like-π-conjugated molecular units is still difficult. Herein, we investigated the liquid-phase exfoliation of porphyrin-containing COFs using common solvents, and found that mechanical stirring is crucial for efficient exfoliation to obtain porphyrin-containing nanodisks (Figure 1).

Porphyrin-containing COFs were synthesized as previously reported by Banerjee *et al*.[2] The COFs and solvent (water, methanol, nitrobenzene, pyridine, etc.) were added into a flask and stirred for 20 hours at boiling point or room temperature to obtain the black samples (e-CONs(solvent)). We observed a considerable acceleration in hydrogen evolution reaction, 2 mmol g^{-1} h^{-1} of H_2 was generated from water using e-CONs(H_2O) as a photocatalyst, which is nearly five times higher than that by the original COFs. [3]

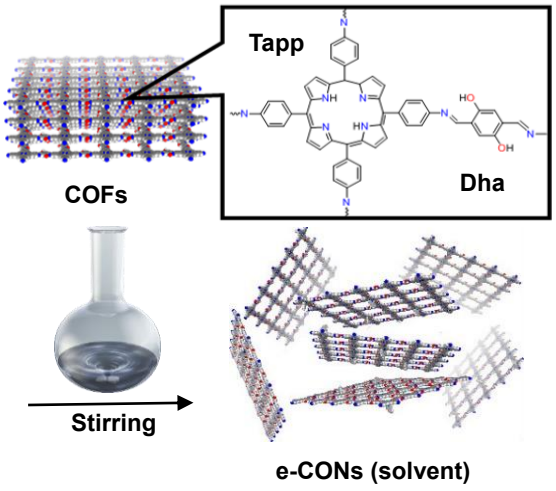

Figure 1. Structure of COFs and synthesis of e-CONs(solvent).

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