Strong Electron-Transfer in Covalently Integrating Cu(I)-Triazine Frameworks Enabling Benchmark Radionuclide Capture

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Abstract

Rational construction of strong electron-transfer materials remains a challenging task. Herein, we show a fundamental design rule for construction of strong electron-transfer materials through covalently integrating electron-donoring Cu(I) clusters and electron-withdrawing triazine monomers together. As expected, the two resultant Cu(I)-triazine frameworks (Cu-CTFs) showed strong electron transfer up to 0.46|e| from each Cu(I) metal center to each adjacent triazine fragment, and the size of triazine monomer was found to give tunable ability for electron transfer. Accompanied to the stronger electron transfer is the observation of more narrow bang gap and good spatial separation of HOMO and LUMO level. This finally leads to good spatial separation of photo-generated electron-hole pairs and function units for boosting photocatalytic reduction of uranium under ambience and no sacrificial agent with ultrahigh removal efficiency up to 99.7%, and good charge separation of [I+][I5-] for boosting I2 immobilization under extremely rigorous conditions with benchmark I2 uptake of 0.32 g/g. The results not only have opened up a structural design principle to access electron-transfer materials, but also solved several challenging tasks in the field of radionuclide capture and CTFs.

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