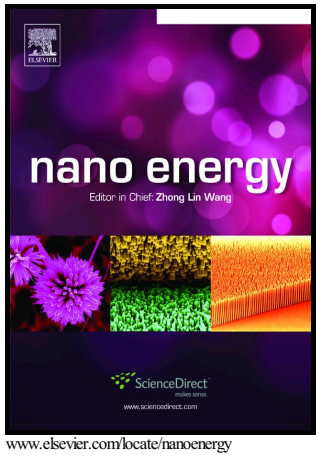

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Covalent Combination of Polyoxometalate and Graphitic Carbon Nitride for Light-Driven Hydrogen Peroxide Production

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Abstract

The polyoxometalate (POM) cluster of $[PW_{11}O_{39}]^{7-}$ (PW_{11}) has been successfully covalent combined with the three dimensionally ordered macroporous graphitic carbon nitride (3DOM g-C_3N_4) through the organic linker strategy. The characterization such as solid-state NMR and XPS results confirm the organosilicon agent of (triethoxysilyl)-propyl isocyanate can act as the linker to covalent combine the PW_{11} cluster with 3DOM g-C_3N_4. The hybrid catalyst of 3DOM g-C_3N_4-PW_{11} exhibits efficient catalytic performance (2.4 μmol·h^{-1}) for light-driven H_2O_2 production from H_2O and O_2 in the absence of organic electron donors. The ESR results suggest that one-electron reduction of O_2 to •OOH is indeed suppressed over 3DOM g-C_3N_4-PW_{11}. Furthermore, the Koutecky-Levich plot obtained from electrochemical rotating disk electrode (RDE) analysis of oxygen reduction reaction (ORR) for 3DOM g-C_3N_4-PW_{11} reveals the value of electron transfer during the ORR process is 2.30, indicating the covalent combination can promote the two-electron O_2 reduction. In addition, the recycle experiment results reveal that the heterogeneous 3DOM g-C_3N_4-PW_{11} is catalytic stable.

Graphical abstract