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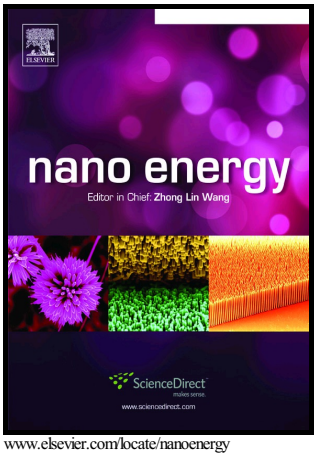

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$Au@Cu_7S_4$ yolk@shell nanocrystal-decorated TiO_2 nanowires as an all-day-active photocatalyst for environmental purification

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Abstract

A vital issue that degrades the entirety of photocatalysis on TiO_2 is the requisite of light illumination for performing redox reactions. The ability to maintain the catalytic activity in dark environment has been the ultimate goal for the widespread deployment of TiO_2 photocatalysts. Here, for the first time we reported the demonstration of an all-day-active photocatalyst model by employing $Au@Cu_7S_4$ yolk@shell nanocrystal-decorated TiO_2 nanowires. The samples were obtained by depositing a Cu_2O layer on the Au surface of Au particle-decorated TiO_2 nanowires, followed by the sulfidation treatment on Cu_2O layer to grow hollow Cu_7S_4 shell. By coupling the pronounced charge separation and distinctive peroxidase mimic properties from the constituents, the TiO_2-$Au@Cu_7S_4$ nanowires were capable of performing efficient methyl orange degradation under light illumination, yet still persisted noticeable activity of decomposing methyl orange after light irradiation was switched off. The present study has embodied a conceptually valuable design of permanently working photocatalysts, which may serve as a versatile platform for the widely distributed environmental and energy applications such as pollutant destruction and organic transformation.

Keywords: all-day-active photocatalysts, TiO_2, yolk@shell nanocrystals, peroxidase mimics