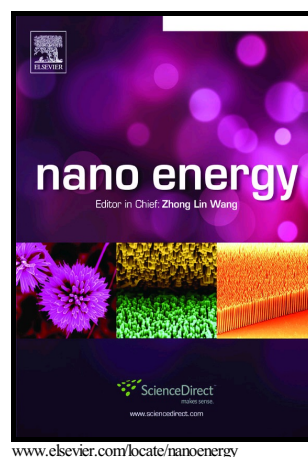


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# Au@Cu<sub>7</sub>S<sub>4</sub> yolk@shell nanocrystal-decorated TiO<sub>2</sub> nanowires as an all-day-active photocatalyst for environmental purification

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## Abstract

A vital issue that degrades the entirety of photocatalysis on TiO<sub>2</sub> 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<sub>2</sub> photocatalysts. Here, for the first time we reported the demonstration of an all-day-active photocatalyst model by employing Au@Cu<sub>7</sub>S<sub>4</sub> yolk@shell nanocrystal-decorated TiO<sub>2</sub> nanowires. The samples were obtained by depositing a Cu<sub>2</sub>O layer on the Au surface of Au particle-decorated TiO<sub>2</sub> nanowires, followed by the sulfidation treatment on Cu<sub>2</sub>O layer to grow hollow Cu<sub>7</sub>S<sub>4</sub> shell. By coupling the pronounced charge separation and distinctive peroxidase mimic properties from the constituents, the TiO<sub>2</sub>-Au@Cu<sub>7</sub>S<sub>4</sub> 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<sub>2</sub>, yolk@shell nanocrystals, peroxidase mimics

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