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Thin MoS₂ on TiO₂ nanotube layers: An efficient co-catalyst/harvesting system for photocatalytic H₂ evolution

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Abstract

In the presentwork, we decorated MoS₂ site-selectively at the top of anodic anatase TiO₂ nanotubes (TiNTs). For this we sputter-deposited a thin layer (0.5 to 10 nm) of molybdenum onto the tops of the tubes and converted it to sulfide by a thermal treatment in H₂S gas. The converted layers were characterized by SEM, XRD and XPS, and tested as an open-circuit photocatalyst for hydrogen evolution. Under AM1.5 (100 mW/cm²) illumination, strongly enhanced H₂ evolution activity can be observed using only a nominal 1 nm thick MoS₂ decoration on top of a 6 μm thick TiNT layer. We ascribe this strong beneficial effect to two factors: (i) the thin molybdenum sulfide on the top acts as an electron transfer mediator, i.e. as an H₂ evolution co-catalyst; and (ii) the underlying tube layer acts as a light-to-electron harvester. (C) 2016 Elsevier B.V. All rights reserved.

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