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Constructing ternary CdS/reduced graphene oxide/TiO_2 nanotube arrays hybrids for enhanced visible-light-driven photoelectrochemical and photocatalytic activity

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Abstract: Ternary nanocomposite photoelectrodes composed of CdS nanocrystallites, reduced graphene oxide (RGO) and TiO_2 nanotube arrays (TNTs) are prepared by a coupling technique of electrophoretic deposition (EPD) and successive ionic layer adsorption and reaction (SILAR). Compare to pure TNTs, RGO/TNTs, and CdS/TNTs, the ternary CdS/RGO/TNTs hybrids show much higher visible-light-driven photoelectrochemical (PEC) and photocatalytic (PC) activity due to that the outer layer of CdS acts as sensitizer for trapping substantial photons from the visible light, the middle layer of RGO not only serves as electrons mediator and transporter for suppressing the recombination of photogenerated carriers, but also plays as a green sensitizer for enhancing visible light absorption, and the inner TNTs with narrowed band gap collect the hot electrons form the CdS and RGO to participate subsequent redox reaction for hydrogen production and organic pollutants degradation.

Keywords: TiO_2 nanotube arrays; graphene; CdS; ternary; photocatalyst