Thermal Replacement Reaction: A Novel Route for Synthesizing Eco-friendly ZnO@γ-In_2Se_3 Hetero-nanostructures by Replacing Cadmium with Indium and theirPhotoelectrochemical and Photocatalytic Performances

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A novel route called thermal replacement reaction was demonstrated for synthesizing eco-friendly ZnO@γ-In2Se3hetero-structural nanowires on the FTO glass by replacing element cadmium with indium for the first time. The indium layer was coated on the surface of the ZnO nanowires beforehand, then the CdSe quantum dots were deposited onto the coated indium layer, and finally the CdSe quantum dots were converted to γ-In2Se3 quantum dots by annealing in vacuum at 350 °C for one hour. The prepared ZnO@γ-In2Se3 hetero-nanostructures exhibit stable photoelectrochemical properties ascribed to the protection of the In2O3 layer between the ZnO nanowire andγ-In2Se3 quantum dots; and better photocatalytic performances in wide wavelength region from 400 nm to nearly 750 nm. This strategy for preparing the ZnO@γ-In2Se3 hetero-nanostructures not only enriches our understanding of the single replacement reaction: the active element cadmium can be replaced with indium; but also opens a new way to in-situ conversion of the cadmium-based to eco-friendly indium-based nano-devices.