

Discovery and optimization of $\text{Zn}_{0.3}\text{Cd}_{0.7}\text{S}$ -based photocatalysts by scanning electrochemical microscopy and characterization of potential photocatalysts

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Scanning electrochemical microscopy (SECM) with a scanning optical fibre was applied to rapidly identify potential $\text{Zn}_{0.3}\text{Cd}_{0.7}\text{S}$ -based photocatalysts for water oxidation. Among the photocatalysts studied, the spot with the precursor composition $\text{Ag}_{0.3}\text{-(Zn}_{0.3}\text{Cd}_{0.7}\text{S)}_{0.7}$ shows the highest photocurrent in 0.1 M $\text{Na}_2\text{SO}_4/\text{Na}_2\text{SO}_3$ solution under both UV-visible and visible light irradiation. The X-ray diffraction and X-ray photoelectron spectrometric analyses reveal that the $\text{Ag}_{0.3}\text{-(Zn}_{0.3}\text{Cd}_{0.7}\text{S)}_{0.7}$ photocatalyst is comprised of monoclinic Ag_2S and solid solution $\text{Zn}_{0.3}\text{Cd}_{0.7}\text{S}$ phases with average crystallite size in the range 18–28 nm. The addition of Ag has little influence on the band gap energy of the $\text{Zn}_{0.3}\text{Cd}_{0.7}\text{S}$ but enhances light absorption in the visible region. The SECM screening results are also confirmed with bulk film studies. The $\text{Ag}_{0.3}\text{-(Zn}_{0.3}\text{Cd}_{0.7}\text{S)}_{0.7}$ electrode exhibits highly efficient visible-light photocatalytic activity with an IPCE value above 20% for a light wavelength of 500 nm.

Keywords: Scanning electrochemical microscopy; photocatalyst; zinc cadmium sulfide; silver sulfide; water oxidation.

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