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Cu Nanoparticle Embedded-Zno Nanoplate Thin Films for Highly Efficient Photocatalytic Hydrogen Production

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Abstract : A novel single-step fabrication of Cu nanoparticle embedded ZnO (Cu.ZnO) thin films was developed by aerosol-assisted chemical vapor deposition for stable and efficient hydrogen production in Photoelectrochemical (PEC) cell. In this approach, the Cu.ZnO nanoplate thin films were grown by using acetic acid to promote preferential growth and enhance surface active sites, where Cu nanoparticles can be formed under chemical deposition by reduction of Cu salt. Studies using photoluminescence spectroscopy indicate the enhanced photocatalytic performance is attributed to hot electron generated from SPR. The Cu metal in the composite material is functioning as a sensitizer to supply electrons to the semiconductor resulting in enhanced electron density for redox reaction. This work not only describes a way to obtain photoanodes with high photocatalytic activity but also suggests a low-cost route towards production of photocatalysts for hydrogen production. This work also supports a vital need to understand electron transfer between photoexcited semiconductor materials and metals, a requirement for tailoring the properties of semiconductor/metal composites.

Keywords : photocatalysis, photoelectrochemical cell (PEC), aerosol-assisted chemical vapor deposition (AACVD), surface plasmon resonance (SPR)
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