

Nanostructured Bi₂S₃/WO₃ Heterojunction Films Exhibiting Enhanced Photoelectrochemical Performance

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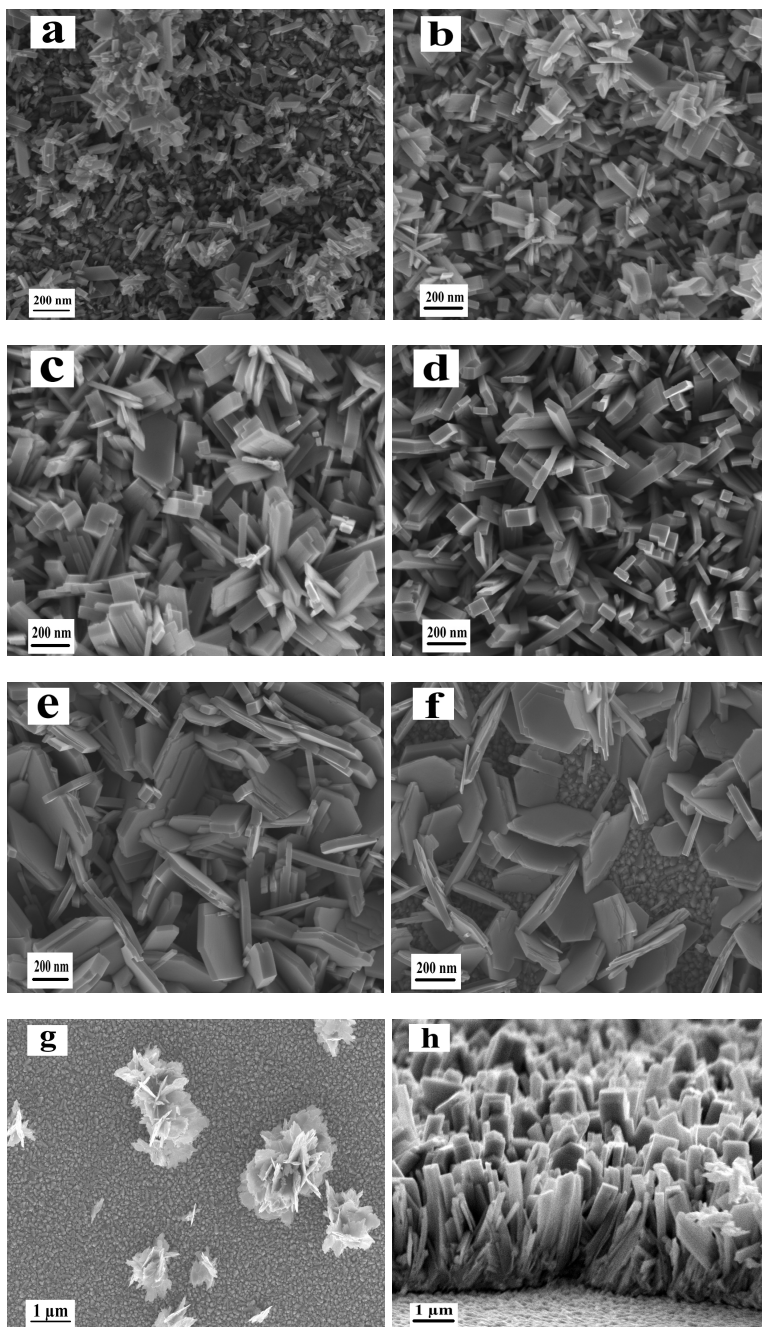


Fig.S1 Top-view SEM images of nanostructure $\text{WO}_3 \cdot 0.33\text{H}_2\text{O}$ film synthesized at a $V_{\text{water}}:V_{\text{ethanol}}$ of (a) 6:0, (b) 5:1, (c) 4:2, (d) 3:3, (e) 2:4, (f) 1:5 and (g) 0:6. (h) Cross-view SEM image of $\text{WO}_3 \cdot 0.33\text{H}_2\text{O}$ nanoprism arrays on FTO-glass substrate synthesized at a $V_{\text{water}}:V_{\text{ethanol}}$ of 3:3.

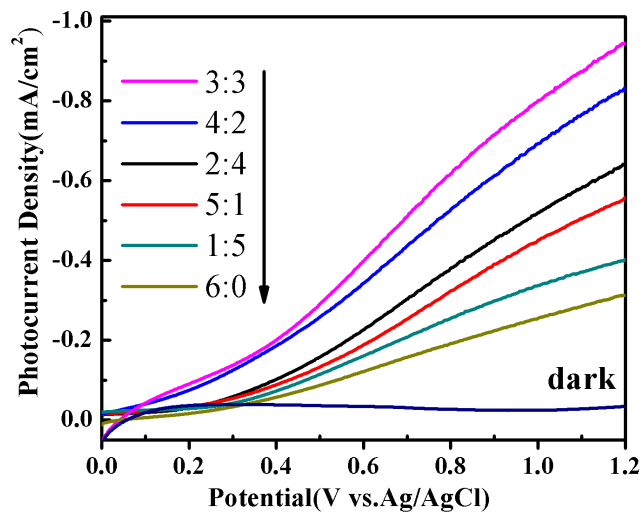


Fig.S2 LSV scans for the as synthesized WO₃ films in 0.1M Na₂SO₄ under backside illumination (100 mW/cm²) employing different ratios of water and ethanol volume for film growth (as indicated in the figure) and without illumination (dark). The scan rate was 50mV/s. Equal volumes of water and ethanol proved best.

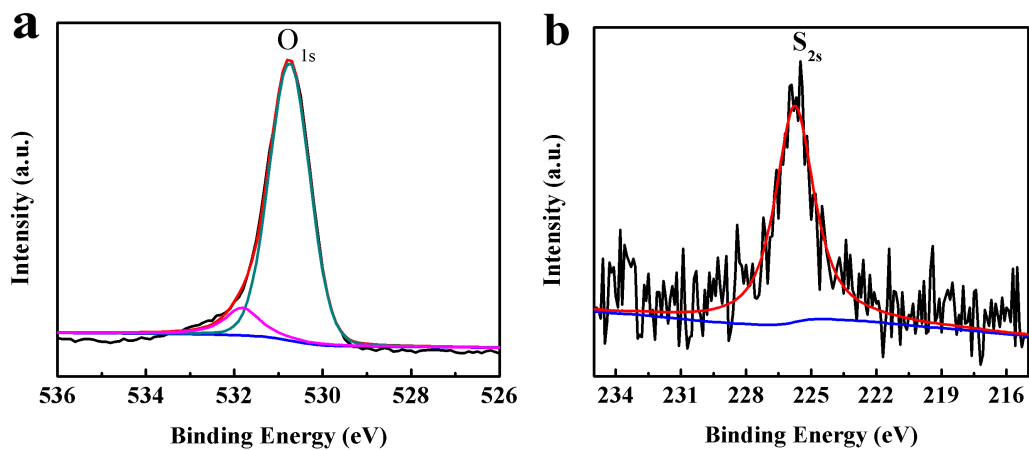


Fig.S3 High resolution XPS spectrum of (a) O_{1s} and (b) S_{2s} for Bi₂S₃/WO₃ heterojunction film.

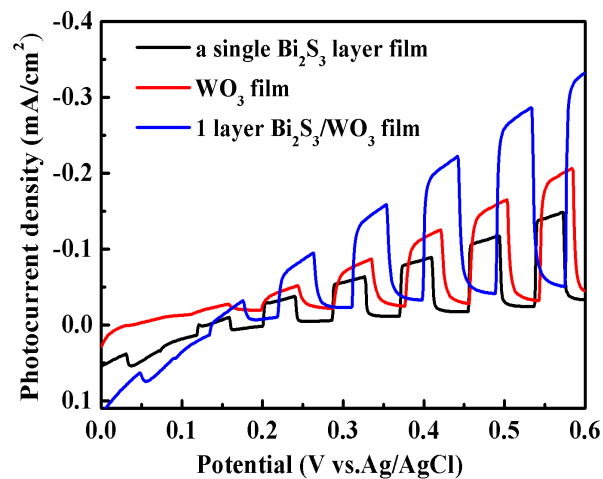


Fig.S4 Chopped LSV scans for single layer Bi₂S₃ film, WO₃ film and 1 layer Bi₂S₃/WO₃ heterojunction film in a non-aqueous solution containing the iodide/triiodide redox couple under illumination with 100 mW/cm² white light. The solution was prepared by dissolving 10 mM I₂ and 50 mM NaI in ethanol. The scan rate was 50mV/s.

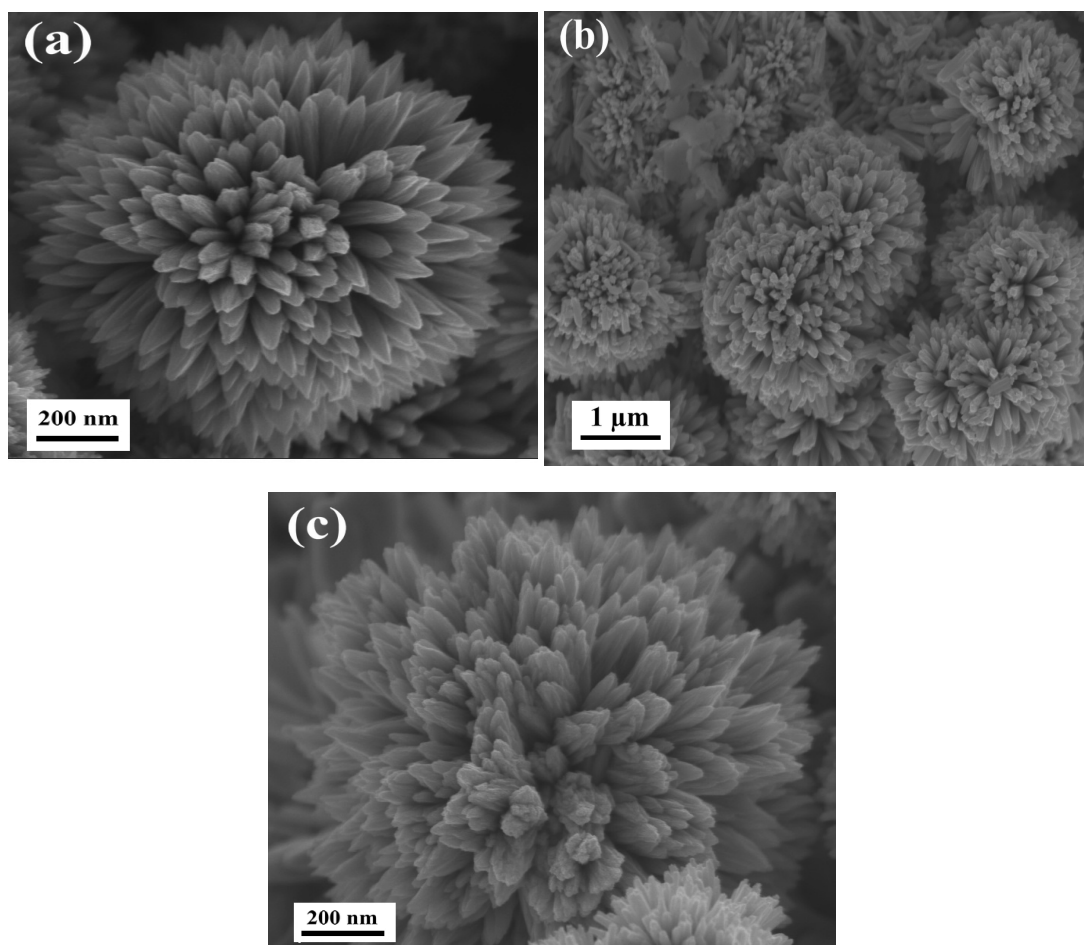


Fig.S5 SEM images of an urchin-like Bi_2S_3 sphere before (a) and after (b and c) the amperometric *i-t* measurement that was conducted in 0.1 M Na_2SO_4 at a constant applied potential of 1.0 V vs. Ag/AgCl under 3600 seconds illumination with 100 mW/cm^2 white light.

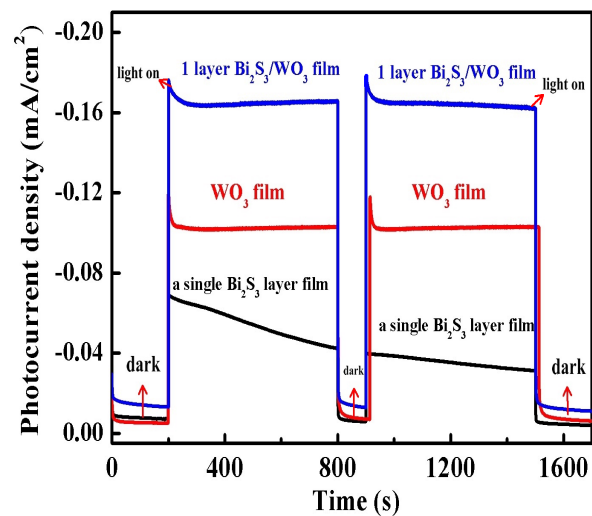


Fig.S6 Amperometric *i-t* curve for single layer Bi₂S₃ film, WO₃ film and 1 layer Bi₂S₃/WO₃ heterojunction film in a non-aqueous solution containing the iodide/triiodide redox couple at a constant applied potential of 0.4 V vs. Ag/AgCl.

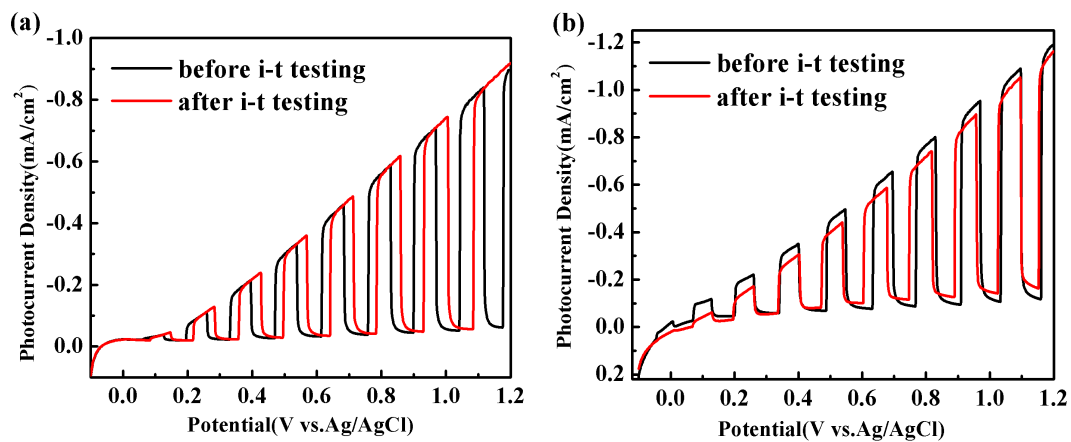


Fig.S7 Chopped LSV scans for (a) a WO₃ film and (b) a one layer Bi₂S₃/WO₃ heterojunction film before and after the amperometric i-t measurements that were conducted in 0.2 M NaCl mixed water-ethanol solution at a constant applied potential of 1.0 V vs. Ag/AgCl under illumination with 100 mW/cm² white light. The scan rate was 50mV/s.

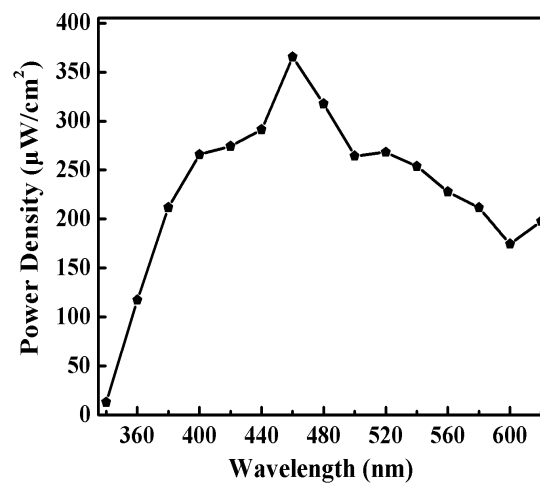


Fig.S8 A typical incident light power density spectrum (from 340 - 620 nm) used for the IPCE measurements.

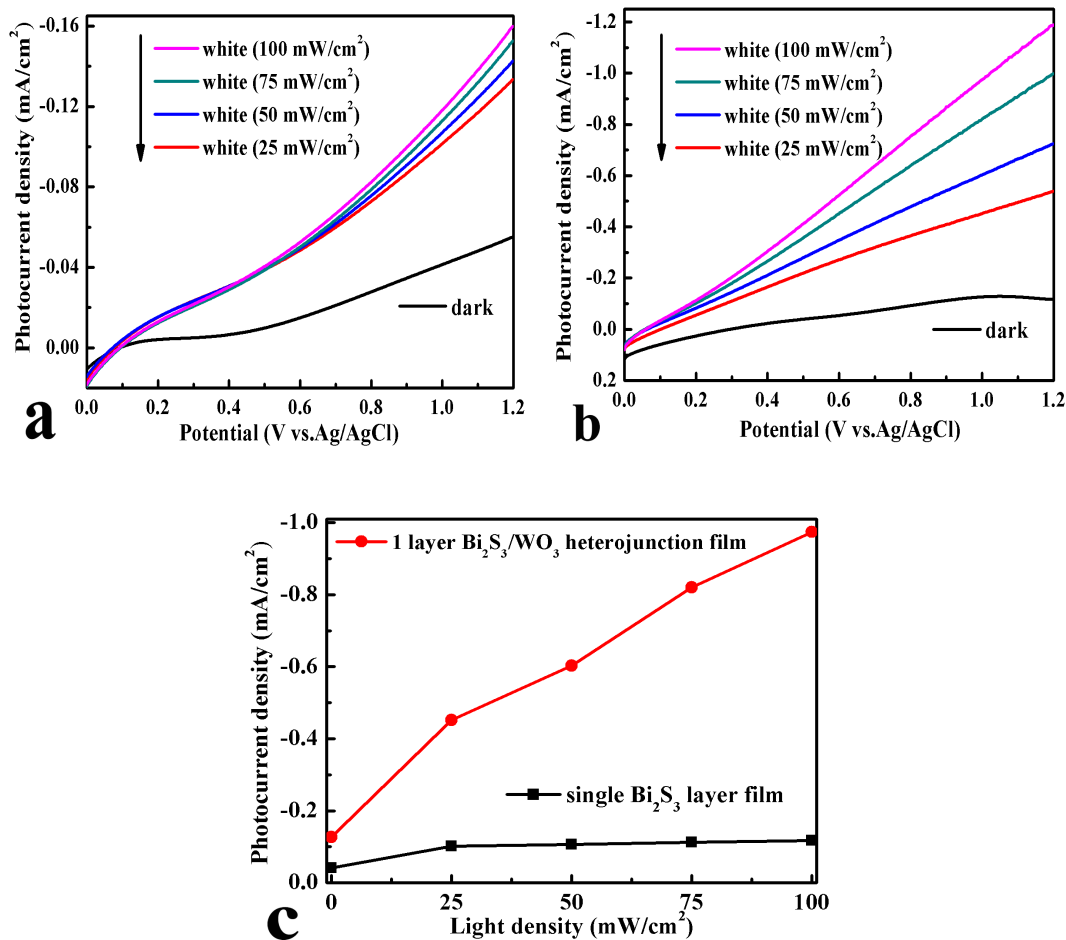


Fig.S9 LSV scans for (a) single Bi₂S₃ layer film and (b) 1 layer Bi₂S₃/WO₃ heterojunction film in 0.2 M NaCl mixed water-ethanol solution without irradiation (dark) and under illumination with different white light intensities. The scan rate was 50mV/s. (c) The photocurrent of single Bi₂S₃ layer film and 1 layer Bi₂S₃/WO₃ heterojunction film in 0.2 M NaCl mixed water-ethanol solution under illumination with different white light intensities at a constant applied potential of 1.0 V vs. Ag/AgCl.

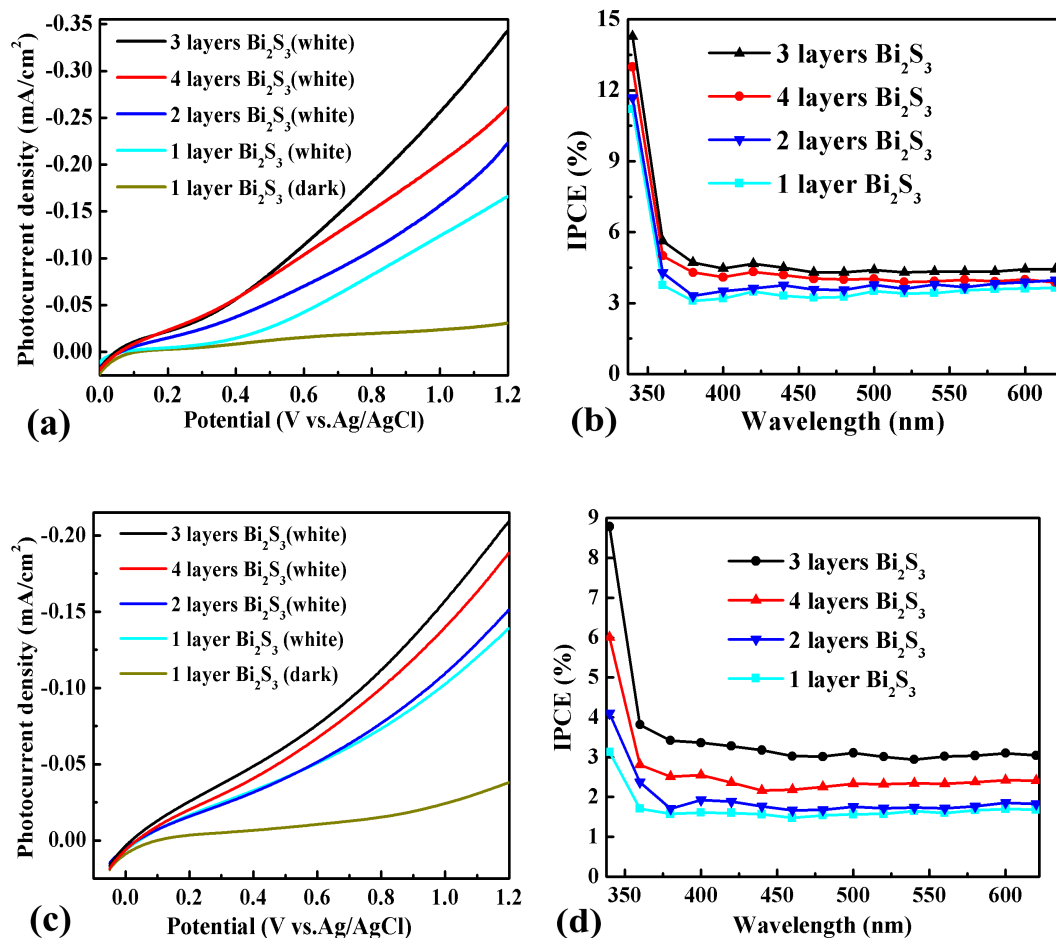


Fig.S10 LSV scans for Bi₂S₃ (only) films synthesized with different numbers of Bi₂S₃ layers on FTO glass substrate in (a) 0.1M Na₂SO₄ and (c) 0.2 M NaCl mixed water-ethanol solution under illumination with white light. The scan rate was 50 mV/s. IPCE spectra for Bi₂S₃ films synthesized with different numbers of Bi₂S₃ layers coated on FTO glass substrate in (b) 0.1M Na₂SO₄ and (d) 0.2 M NaCl mixed water-ethanol solution at a constant applied potential of 1.0 V vs. Ag/AgCl.