From single ZnO multipods to heterostructured ZnO/ZnS, ZnO/ZnSe, ZnO/Bi_2S_3, and ZnO/Cu_2S multipods: controlled synthesis and tunable optical and photoelectrochemical properties

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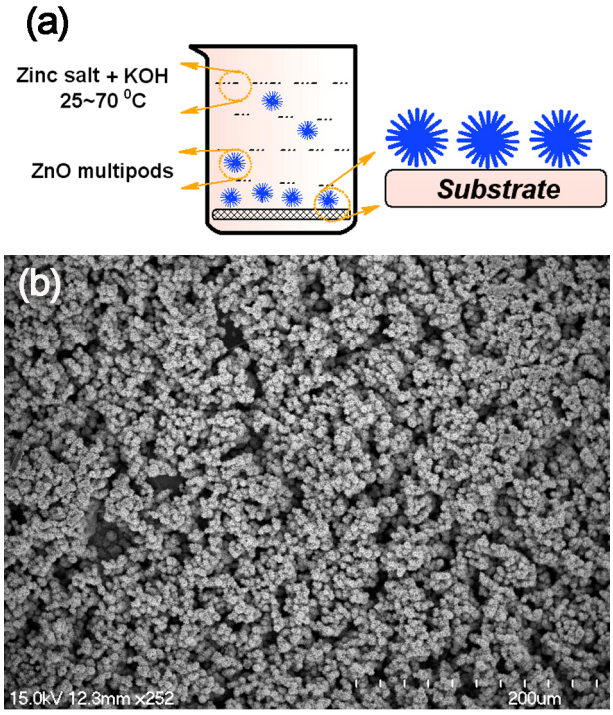
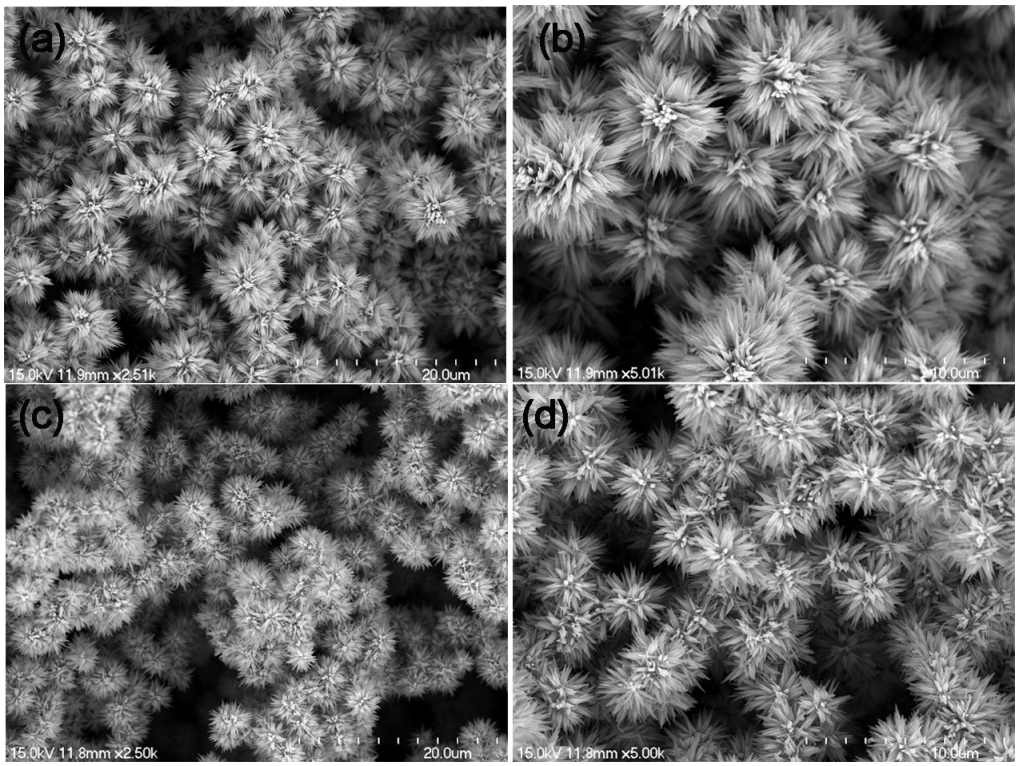
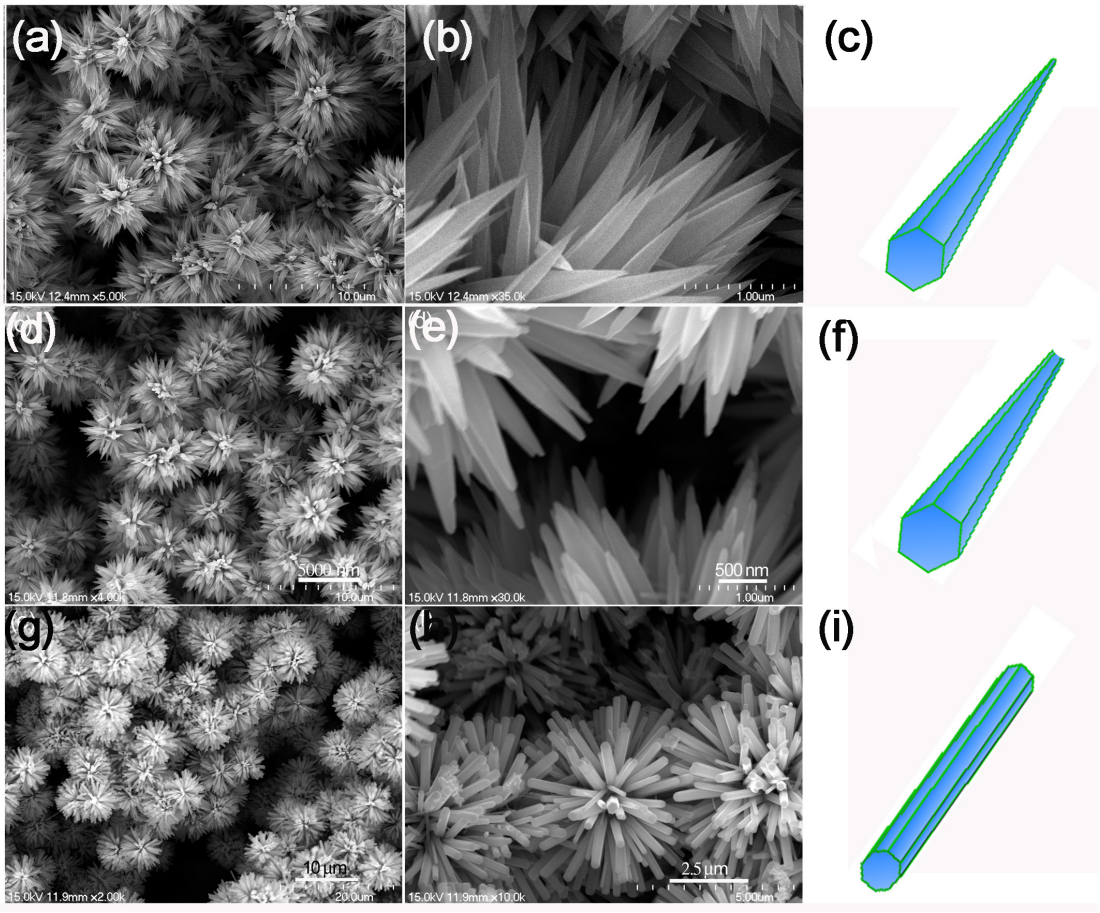


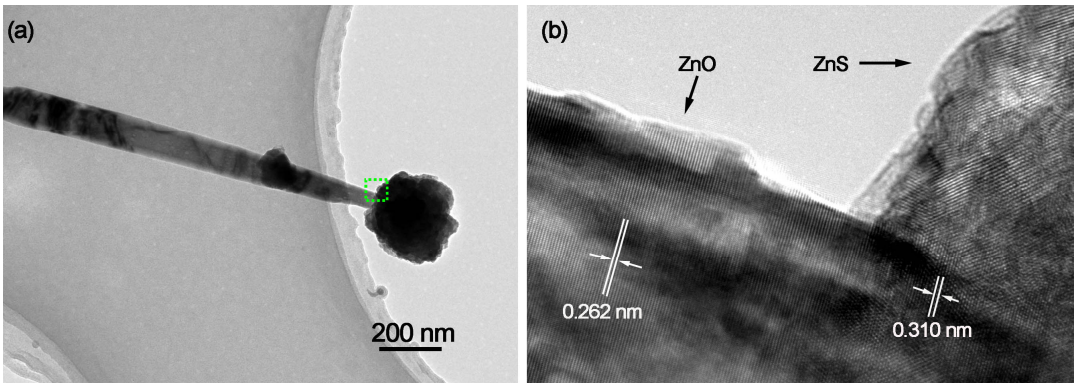
FS1. (a) Schematic description of the synthesis of ZnO multipods, where the substrate can be metal sheets, silicon wafer, glass, or flexible polyester film. (b) A low magnification FESEM image shows the extremely high yield of the multipods prepared via the above route.



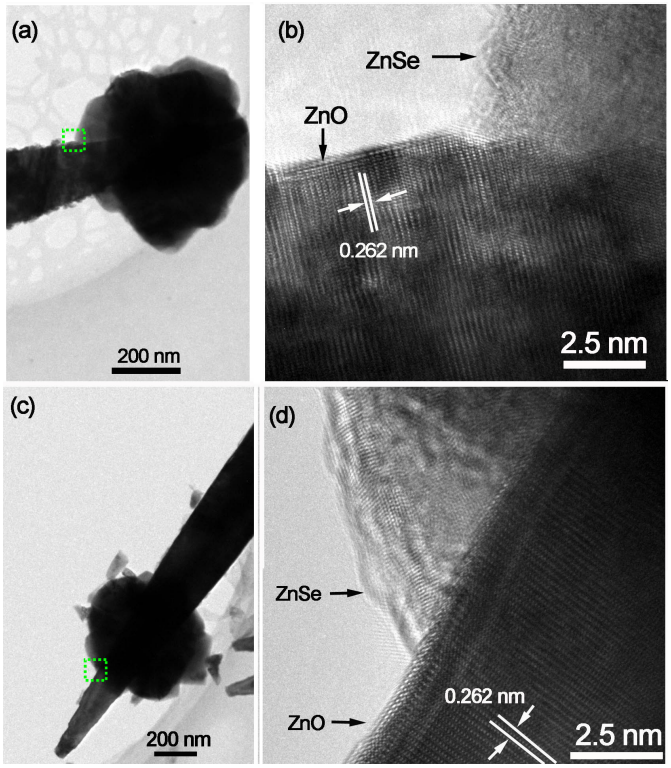
FS2. (a) and (b) FESEM images of ZnO multipods collected with copper sheet. (c) and (d) FESEM images of ZnO multipods collected with polyester film.



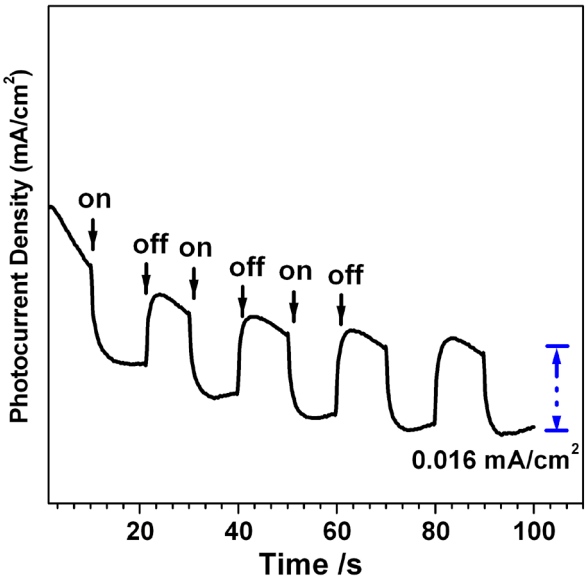
FS3. (a) and (b) FESEM images of ZnO multipods prepared at 25 °C. (c) Diagrammatic description of the shape of the branches of the multipods prepared at 25 °C. (d) and (e) FESEM images of ZnO multipods prepared at 50 °C. (f) Diagrammatic description of the shape of the branches of the multipods prepared at 50 °C. (g) and (h) FESEM images of ZnO multipods prepared at 70 °C. (i) Diagrammatic description of the shape of the branches of the multipods prepared at 70 °C.



FS4. (a) TEM image shows the supporting of ZnS particle by the tip of the branch. (b) HRTEM image taken on the region marked by the box in Panel a, confirming that the polycrystalline ZnS particle is attached on ZnO.



FS5. (a) TEM image shows the supporting of ZnSe particle by the tip of the branch. (b) HRTEM image taken on the region marked by the box in Panel a. (c) TEM image shows the ZnSe particle grown far away from the tip. (d) HRTEM image taken on the region marked by the box in Panel c. Since the ZnSe particles and the branches are not on a same plane, we can not determine the lattice separations of the ZnSe particles accurately. But the results of elemental analysis suggest that the elements within the particles are stoichiometric Zn and Se. That is, the particles are actually ZnSe in structure.



FS6. Short-circuit photocurrent density vs. time curves of ZnO/Cu_2S multipods. Electrolyte solution: 0.1 mol/L Na_2SO_4. Abnormally, the illumination of ZnO/Cu_2S multipods causes a dramatical decrease of the current, rather than the enhancement.