Supporting Information

All Inorganic Semiconductor Nanowire Mesh for Artificial Photosynthesis

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Figure SI-1. FESEM images of $\text{H}_2\text{Ti}_3\text{O}_7$ nanowires and $\text{Na}_2\text{V}_6\text{O}_{16}\cdot3\text{H}_2\text{O}$ nanowires.
Figure SI-2. TEM images of BiVO$_4$ nanowires.
Figure SI-3. HRTEM images of (a) Rh-SrTiO$_3$ nanowires and (b) BiVO$_4$ nanowires.
Figure SI-4. (a) H₂ evolution from 2 mg of Rh-SrTiO₃ nanowires loaded with 1 wt % of Ru in 3 ml water-methanol solution under visible light irradiation, and (b) O₂ evolution from 2 mg of BiVO₄ nanowires in 3 ml Fe₂(SO₄)₃ aqueous solution under visible light irradiation.
Figure SI-5. H\textsubscript{2} and O\textsubscript{2} evolution from Rh-SrTiO\textsubscript{3} and BiVO\textsubscript{4} nanowires in 3 ml of water at pH = 3.5 (adjusted using dilute H\textsubscript{2}SO\textsubscript{4}) under visible light irradiation. The photocatalyst amount was 15 mg. Note: the faster O\textsubscript{2} evolution rate as compared with H\textsubscript{2} evolution rate is due to O\textsubscript{2} leakage from ambient air.
Figure SI-6. (a) XRD pattern and (b) UV-vis spectrum of mixed Rh-SrTiO$_3$ and BiVO$_4$ nanowire mesh film.
**Figure S1-7.** FESEM images of mixed Rh-SrTiO$_3$ and BiVO$_4$ nanowire mesh film.
**Figure S1-8.** Cross-sectional FESEM image to show the interface of the Rh-SrTiO$_3$ and BiVO$_4$ bilayer nanowire mesh.
Figure S1-9. (a) Proposed band structure and visible light response of Rh-SrTiO$_3$ nanowires. (b) Scheme of photocatalytic overall water splitting based on Ru/Rh-SrTiO$_3$ and BiVO$_4$ nanowire system.$^{1-4}$

References:

Note: The photoactivity of the nanostructured Rh-SrTiO$_3$ and BiVO$_4$ nanowire film is about one order of magnitude lower than that of the previously reported powder mixtures (reference: J. Phys. Chem. C 2009, 113, 17536-17542. J. Am. Chem. Soc. 2011, 133, 11054-11057). The possible reasons for this observed lower photoactivity of our nanostructured Rh-SrTiO$_3$ and BiVO$_4$ nanowire film can be explained as the following: 1. The dispersed powder mixtures have better light absorption efficiency than the compact nanowire mesh film. 2. The previously reported experiment was carried out at low pressure (40 Torr) and our experiment was done at atmospheric pressure (~ 800 Torr). 3. The gas evolution and reactant diffusion could be a problem in our compact nanowire mesh film. 4. The illumination method used in our experiment was different from the previously reported method, which might affect the light absorption efficiency in our experiment. 5. The crystal quality of our Rh-SrTiO$_3$ and BiVO$_4$ nanowires prepared using the ion-exchange method as compared with the Rh-SrTiO$_3$ and BiVO$_4$ powders prepared using high-temperature sintering method may affect the photoactivity.