Supporting Information

Cobalt-bilayer Catalysts Decorated Ta$_3$N$_5$ Nanorod Array as Integrated Electrodes for Photoelectrochemical Water Oxidation

Jungang Hou, Chao Yang, Zheng Wang, Huijie Cheng, Shuqiang Jiao, Hongmin Zhu

State Key Laboratory of Advanced Metallurgy, School of Metallurgical and Ecological Engineering, University of Science and Technology Beijing, Beijing 100083, China

Corresponding author: sjiao@ustb.edu.cn; hzhu@ustb.edu.cn

Tel: (+86) 10 62334204; Fax: (+86) 10 62334204
Figure S1. XRD patterns of (a) F-Ta$_2$O$_5$ nanorod arrays and (b) Ta$_3$N$_5$ nanorod arrays on the Ta substrates.
Figure S2. High resolution TEM image recorded from a single F-Ta$_2$O$_5$ nanorod with preferential growth along the [001] direction.
**Figure S3.** Energy-dispersive X-ray spectroscopy of the elements Ta, O and F in the F-Ta$_2$O$_5$ nanorod samples.
**Figure S4.** Typical cross-sectional SEM image of the Ta₃N₅ nanorod array.
Figure S5. UV-visible absorption spectrum of commercial Ta$_2$O$_5$, F-Ta$_2$O$_5$ nanorods, and Ta$_3$N$_5$ nanorods samples.
Figure S6. The O₂ production of Co₃O₄/Co(II)/Ta₃N₅ nanorods measured in 1.0 M NaOH solution (pH=13.6) in the three electrode system at an applied potential of 1.23 V vs. RHE AM 1.5G simulated sunlight at 100 mW/cm². The oxygen evolution by photoelectrochemical water splitting was conducted in the airtight reactor connected to a closed gas circulation system. The 300W Xe lamp (MAX-302, Asahi Spectra) under AM 1.5G illumination with a density of 100 mW cm⁻² (Newport) was used to irradiate only visible light. The amount of oxygen was determined by a gas chromatography (GC-3240) equipped with TCD (molecular sieve 5 Å column, Ar carrier gas).
Figure S7. XPS spectra of Co 2p for Co₃O₄/Co(II)/Ta₃N₅ nanorods.