Electronic Supplementary Information

Molten salt-assisted $\alpha$-axis oriented growth of $\text{Ta}_3\text{N}_5$ nanorod array with enhanced charge transport for efficient photoelectrochemical water oxidation

Zhan Shi,$^{a,c}$ Zhe Xu,$^{a,b}$ Jianyong Feng,$^{a,b}$ Huiting Huang,$^{a,b}$ Qinfeng Qian,$^{a,b}$ Shicheng Yan$^{a,b,*}$ and Zhigang Zou$^{a,b,c}$

$^a$Collaborative Innovation Center of Advanced Microstructures, Nanjing University, Nanjing, 210093, P. R. China. E-mail: yscfei@nju.edu.cn

$^b$Eco-materials and Renewable Energy Research Center (ERERC), National Laboratory of Solid State Microstructures, College of Engineering and Applied Science, Nanjing University, Nanjing 210093, P. R. China.

$^c$Jiangsu Key Laboratory For Nano Technology, Department of Physics, Nanjing University, Nanjing, 210093, P. R. China.

Fig. S1 a) SEM image of the pre-oxidized Ta foil. b) SEM image of NR powder fabricated by $\text{Ta}_2\text{O}_5$ powder and KI flux.
Fig. S2 XRD patterns of the time-course experiment of the NR growth using 2 g KI flux.
Fig. S3 XPS spectra of a) Ta 4f b) N 1s c) K 2p d) I 3d of the as-synthesized photoanodes.
Fig. S4 SEM images of Ta$_3$N$_5$ photoanodes synthesized by using a) NaI and b) KBr as flux.

Fig. S5 Current density-potential curves of Ta$_3$N$_5$-2 photoanodes with varied growth time. Ni$_{0.9}$Fe$_{0.1}$OOH was electrochemically deposited for 100 s as the co-catalyst for all the photoanodes.
Fig. S6 Stability test of Ta$_3$N$_5$-2 photoanode with Ni$_{0.9}$Fe$_{0.1}$OOH. The stability of Ta$_3$N$_5$-2 nanorod photoanode is not so good, which can be attributed to the surface corrosion by holes and leaky co-catalyst that does not prevent from the infiltration of electrolyte.

Fig. S7 a) Schematic diagram of conductivity measurement of Ta$_3$N$_5$ photoanodes. The area of Ga droplet is about 4 mm$^2$. b) $J$-$V$ curves of the conductivity
measurement. For comparison, a planar nanoparticle Ta₃N₅ film of about 2 μm-thick was fabricated with simple oxidation-nitridation method. The linearly fitted conductivities at V=0 V for Ta₃N₅ nanoparticle film, Ta₃N₅-1, Ta₃N₅-1.5 and Ta₃N₅-2 are 0.02, 3.61, 3.46, and 3.58 Ω⁻¹ cm², respectively.