Supporting Information

Visible Light Assisted Photocatalytic Hydrogen Generation by Ta₂O₅/Bi₂O₃, TaON/Bi₂O₃, and Ta₃N₅/Bi₂O₃ Composites

Shiba P. Adhikari, Zachary D. Hood, Karren L. More, Iliia Ivanov, Lifeng Zhang, Michael Gross, and Abdou Lachgar

1.1 Synthesis of tantalum oxide nanoparticles

In a typical synthesis of tantalum oxide nanoparticles, 1 g of tantalum chloride was dissolved in 60 mL of anhydrous benzyl alcohol. The whole mass was sealed in a Teflon lined autoclave and heated at 220 °C for 48 hours. The solid mass was obtained by centrifugation, washed with ethyl alcohol several times and vacuum dried at 70 °C overnight. Based upon the thermogravimetric analysis, the sample was calcined at 700 °C for 2 hours to obtain the pure phase of tantalum oxide (TA-700).¹

1.2 Synthesis of tantalum oxynitride and tantalum nitride

In a typical synthesis of tantalum oxynitride (TaON), 500 mg of Ta₂O₅ powder were heated at 825 °C for 6 hours in a tube furnace under a constant flow of ammonia (20 mL/ min) where ammonia gas was passed through a round bottom flask containing deionized water. Similarly tantalum nitride (Ta₃N₅) was synthesized from Ta₂O₅ powder under the same conditions but using dry ammonia (without passing the ammonia through deionized water).²

Fig. 1S- XRD patterns of tantalum oxide nanoparticle (a) and as synthesized BITA composite before heating at 400 °C (b)
Fig. 2SI-SEM images and EDS spectrum of bismuth tantalate (BITA-1000).

Fig. 2SII- SEM images of Tantalum oxynitride (a) and tantalum nitride (b).

Fig. 2SIII- EDS spectrum of Tantalum oxynitride (a) and tantalum nitride (b).
**Fig. 3S**- TEM images of tantalum oxide nanoparticle. (a) as synthesized and (b) calcined at 700 °C.

**Fig. 4S**- UV/Vis diffuse reflectance spectra of synthesized products.

**Fig. 5S**- Thermogravimetric analysis of a) BITA composite b) tantalum oxide c) bismuth oxide
Fig. 6S- $N_2$ adsorption desorption isotherms of BITA-400, BITON, BITN and BITA-1000

References
