Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Visible Light Assisted Photocatalytic Hydrogen Generation by Ta_2O_5/Bi_2O_3, $TaON/Bi_2O_3$, and Ta_3N_5/Bi_2O_3 Composites

Shiba P. Adhikari,[a, b] Zachary D. Hood,[c] Karren L. More,[c] Ilia Ivanov,[c] Lifeng Zhang,[d] Michael Gross,[a, b] and Abdou Lachgar*[a, b]

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 ^{0}C for 48 hours. The solid mass was obtained by centrifugation, washed with ethyl alcohol several times and vacuum dried at 70 ^{0}C overnight. Based upon the thermogravimetric analysis, the sample was calcined at 700 ^{0}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 Ta_2O_5 powder were heated at 825 ^{0}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 (Ta_3N_5) was synthesized from Ta_2O_5 powder under the same conditions but using dry ammonia (without passing the ammonia through deionized water).[2]

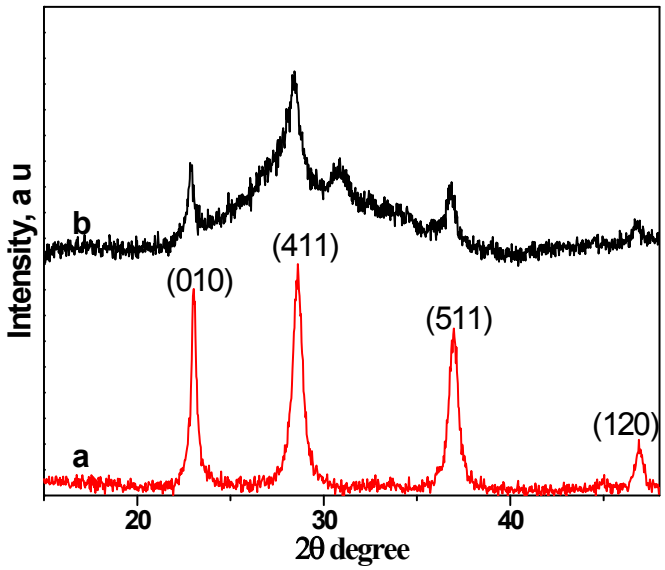

Fig. 1S- XRD patterns of tantalum oxide nanoparticle (a) and as synthesized BITA composite before heating at 400 ^{0}C (b)

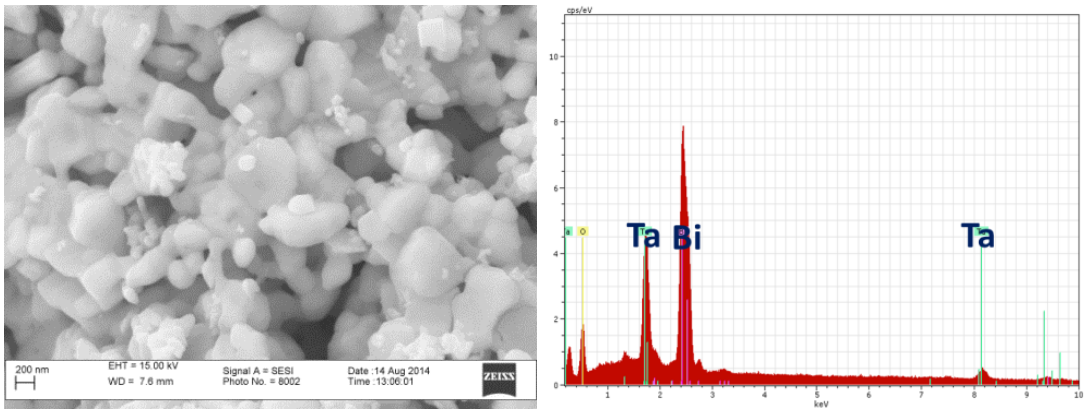

Fig. 2SI-SEM images and EDS spectrum of bismuth tantalate (BITA-1000).

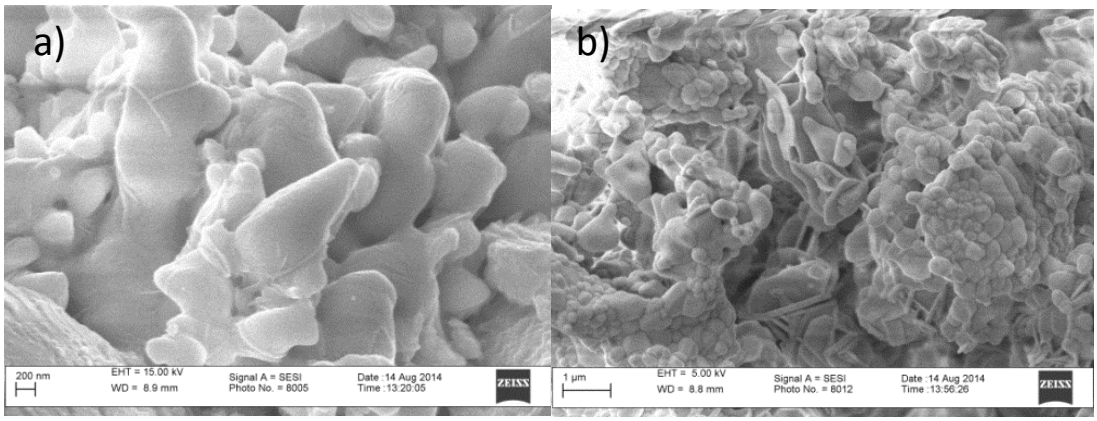

Fig. 2SII- SEM images of Tantalum oxynitride (a) and tantalum nitride (b).

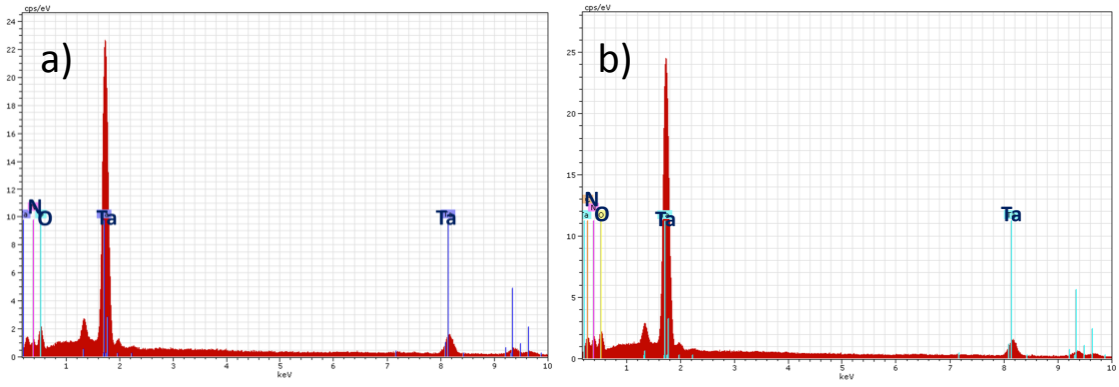

Fig. 2SIII- EDS spectrum of Tantalum oxynitride (a) and tantalum nitride (b).

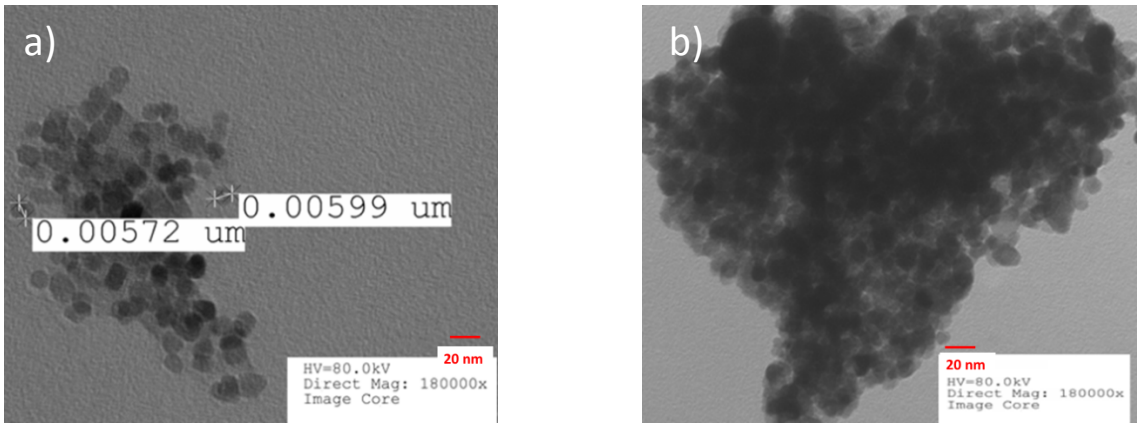

Fig. 3S- TEM images of tantalum oxide nanoparticle. (a) as synthesized and (b) calcined at 700 ^{0}C.

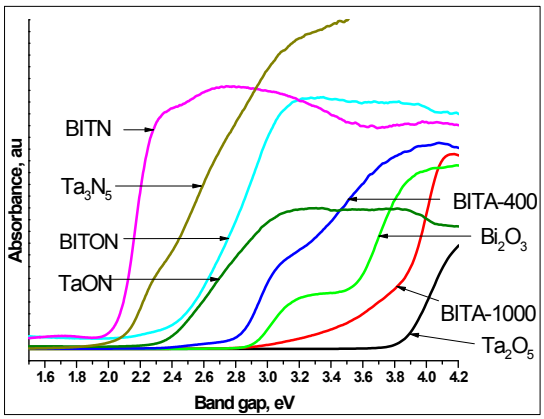

Fig. 4S- UV/Vis diffuse reflectance spectra of synthesized products.

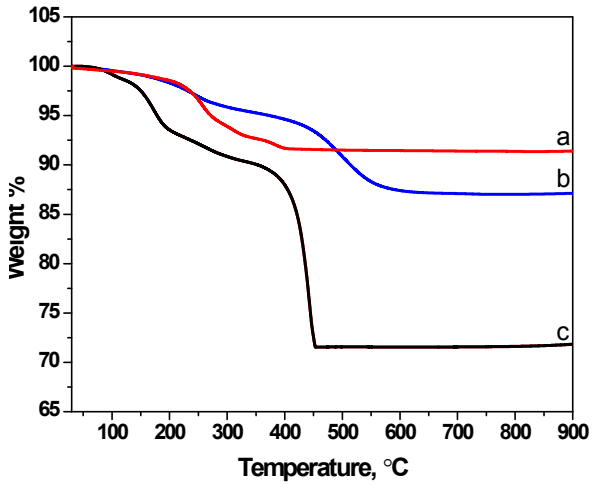

Fig. 5S-Thermogravimetric analysis of a) BITA composite b) tantalum oxide c) bismuth oxide

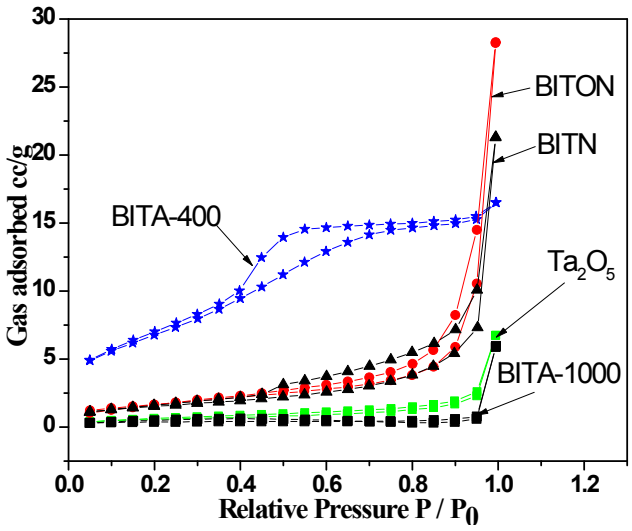

Fig. 6S- N_2 adsorption desorption isotherms of BITA-400, BITON, BITN and BITA-1000

References

1. J. Buha, D. Arcon, M. Niederberger and I. Djerdj, *Phys. Chem. Chem. Phys.*, 2010, **12**, 15537-15543
2. M. Y. Tsang, **Macroporous semiconductors tantalum oxide, (oxy)nitride and nitride for photocatalytic hydrogen evolution**. M.Sc. thesis; University of York, 2010.