**Morphology and microstructural characterization of Mo-doped Bi2WO6**

Paraguay, F.[1], Antúnez-Flores, W.[1], Ornelas, C.[1], Basurto-Cereceda, S.[1], Homeniuk, D.[2], Malac, M.[2] and Borja-Urby, R.[3]

[1] Centro de Investigación en Materiales Avanzados SC (CIMAV), Laboratorio Nacional de Nanotecnología, Miguel de Cervantes No.120, C.P. 31136, Chihuahua, Chih.,, Mexico, [2] Nanotechnology Research Center, 11421 Saskatchewan Drive, T6G 2M9, Edmonton, Alberta,, Canada, [3] Centro de Nanociencias Micro y Nanotecnología. Instituto Politécnico Nacional, Unidad Prof. Adolfo López Mateos, Zacatenco, Delegación Gustavo A. Madero, 07738 México City,, Mexico

Nanostructured bismuth tungsten oxide ($Bi_2WO_6$) referred to as BWO attracted interest due to its optical properties. It has good visible light photocatalytic efficiency for fotodegradation of contaminants in water [1]. The material was explored for conversion solar energy by itself and as composite with other oxides. Mo doped BWO (Mo-BWO) has a band gap suitable for solar radiation absorption close to visible range of the spectrum. A detailed microstructure characterization of the doped BWO is important to measure the dopant localization and to understand its morphology changes. Mo-BWO with 0 and 2 %at Mo/W were prepared by hydrothermal assisted microwave radiation [2]. The samples were studied by scanning electron microscope (SEM) and scanning transmission electron microscope (STEM) and nanobeam diffraction mode (STEM-NBD). Images were acquired in a field emission JEOL JEM-2200FS microscope with probe aberration corrector operated at 200 kV. Nano beam electron diffraction (NBD) patterns were obtained in a STEM mode by Hitachi HF-3300 analytical TEM / STEM microscope operated at 300 kV.

According to the SEM images (Fig. 1a), the morphology of the synthesized materials are round conglomerates of lamellar particles. Their lateral size is ~4 um, each layer is ~40 nm of thick and 150 nm in diameter (Fig. 1c). A detailed HAADF STEM image of the particle is shows in Fig. 1b, it show some lamellae are thinner than others with mean thickness ~5 nm. Energy dispersive spectroscopy (EDS) analysis in different zones show the presence of Mo doping. X-ray diffraction and selected area diffraction that are both averaging over large volume of the sample, show that the crystal structure is the same for doped and undoped samples. To assess Mo doping influence on the optical properties, it is necessary determine the structure of individual Mo-BWO particles. To obtain local structure, the STEM-NBD patterns were acquired using nearly parallel STEM beam ~5 nm diameter and ~1 mrad convergence angle. The Fig. 1d shows an example of STEM-NBD, acquired from position 2 in Fig. 1c, as indicated by an arrow. The structure and cell parameters for individual lamellar particle of Mo-BWO were determined from STEM-NBD.

The results indicate that Mo doping does not affect in the morphology and structure of the lamellae within Mo-doped BWO.

**References**

[1] Weili Dai et al. 2015, Appl. Surf. Sci., vol. 356, pp. 173 - 180.

[2] D. Morales-Cruz, F. Paraguay-Delgado, R. Borja-Urby, S. Basurto-Cereceda, G. Herrera-Pérez, P. Longo, and M. Malac (2017). Materials Science in Semiconductor Processing, 63, 184-189.

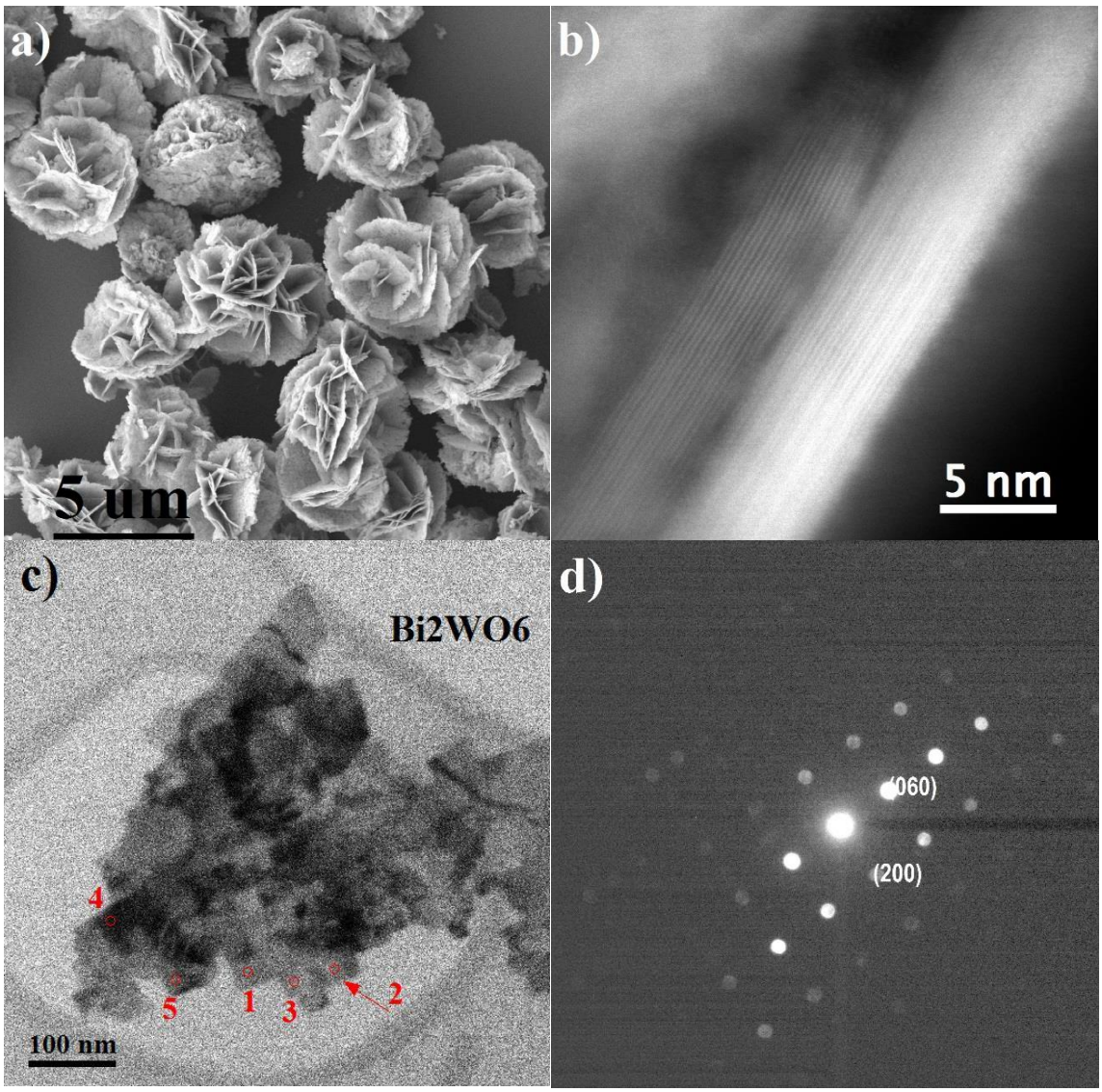


Figure 1. Images for Bi2WO6. a) SEM round shape agglomerate lamellar particles, b)STEM image by HAADF cross section of lamellar particles, c) STEM image with positions from where were acquired STEM-NBD patterns and d) NBD pattern from position 2 (image 1c).