Effect of reaction time on structural and enhanced electrical properties of h-WO_3 nanostructures for UV photodetector applications

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Abstract. The hexagonal WO_3 nanostructures were synthesized by varying the reaction time of hydrothermal treatment as 2,4,6 and 8 h and characterized using X-ray diffractometer (XRD), absorption spectroscopy, scanning electron microscopy(SEM) and Raman spectroscopy. The hexagonal structure of prepared WO_3 was confirmed from XRD pattern in *figure I*. Lattice strain is calculated and their variation with different hydrothermal studies has been studied. The reaction time induced lattice strain was calculated. The absorption peak is obtained at 290 nm and the bandgap is varying from 2.9 to 3.1 eV. The role of reaction time in the evolution of morphology has been studied from the SEM image. It shows the evolution of stacked-layer structure to the flower-like morphology and then distorted to form a rod when reaction time increases is shown in *figure IV*. Raman spectra has been recorded for all three samples and is shown in *figure III*. It has been noted that the FWHM and the peak position of stretching vibration mode varies with reaction time. The variation of strain calculated from XRD, FWHM and peak position is shown in *figure II*. The change in Raman laser energy violates the vibration of the bonds, influences the vibrational spectra and causes shift and broadening in the Raman bands. The surface temperature has calculated from Raman stokes and anti-stokes lines intensity ratio with increasing laser power. The absorption in UV region around 290 nm makes it a suitable candidate for UV photodetector applications. IV measurement of a prepared sample in dark and UV modes shows high responsivity and sensitivity.

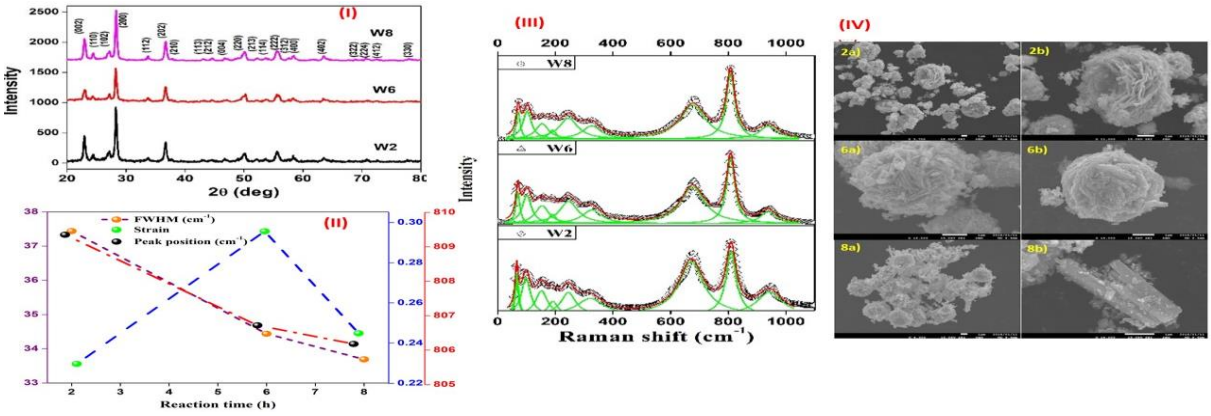

Figure: (I) XRD pattern of prepared sample shows the hexagonal structure of WO_3. (II) comparison of strain calculated from XRD and FWHM and peak position of Raman band. (III) Raman spectra of WO_3 samples prepared. (IV) FESEM image shows the varying morphology of prepared sample with varying reaction time.