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Characterization of VO_2 Structures Performed by Electrodeposition

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Abstract – VOx particules were deposited onto p-doped Si (100) substrates using potentiostatic electrodeposition. By vacuum annealing (3 hours at 450 °C, pressure of 10^{-7} mbar), we obtained polycrystalline VO_2 particules (Fig. 1).

We report on the structural and electronic properties of vanadium oxide (VO_x) particules prepared by potentiostatic electrodeposition on Si(100) substrates. Different properties can be observed as a function of the phase vanadium oxides. Among the transition metal oxide semiconductors, vanadium dioxide, especially in thin film form, has attracted considerable interest over the years owing to their wide range of applications. Vanadium dioxide (VO_2) has a thermal-induced semiconductor-to-metal transition at 68°C [1]. Below his transition temperature, it is a narrow gap (0.7 eV) semiconductor. In this work vanadium oxide particules were obtained from aqueous vanadium (IV) oxide sulfate hydrate ($VOSO_4.xH_2O$) solutions at cathodic potential (-0.75 V *versus* Ag-AgCl reference electrode) with 1.5 h of deposition. According to x-ray diffraction (XRD) the as deposited samples consist of polycrystalline VO_x particules. For this reason the samples were annealed at a pressure of 10^{-7} mbar for 3 hours at 450 ^oC. The XRD results for annealed samples show that the vanadium oxide particule change from VOx to VO_2 (Monoclinic, Space Group C2/m, Card Number: 76-673). Analyses of Scanning Electron Microscope (SEM) show microstructures with different sizes in the same sample (Fig. 2).

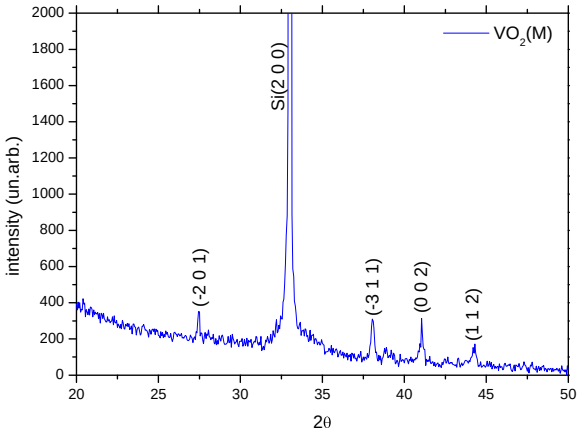

Figure 1: XRD patterns of sample electrodeposition at cathodic potential of 0.75 V with 1.5 hours, annealed at pressure of 10^{-7} mbar for 3 hours at 450°C.

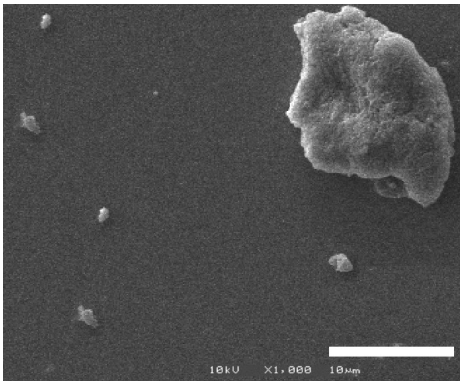

Figure 2: SEM image of a VO_x particle deposited.

[1] F. J. Morin. Phys. Rev. Lett. **3**, 34, (1959).